23 DECEMBER 1954 NINEPENCE

ELECTRICAL TIMES

To all our Friends in the Industry - Every Good Wish for Christmas and the New Year

HENLEY CABLES

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. 51-53 HATTON GARDEN, LONDON, E.C.1.

HIGH BAY LIGHTING — BY BENJAMIN

...at one of the world's largest Ships' Engine shops

A typical example of Benjamin High Bay lighting is this installation at the huge Cammell Laird works, Birkenhead. 1500 watt lamps—*mounted 74 ft. above floor level*—are fitted with heavy duty 'Saaflux' tops and clear glass 'Visor' Covers, rendering each unit entirely dust-proof.

For the lighting of lofty interiors . . . for the considered planning of *any* lighting scheme . . . consult the Benjamin Illuminating Engineering Service.

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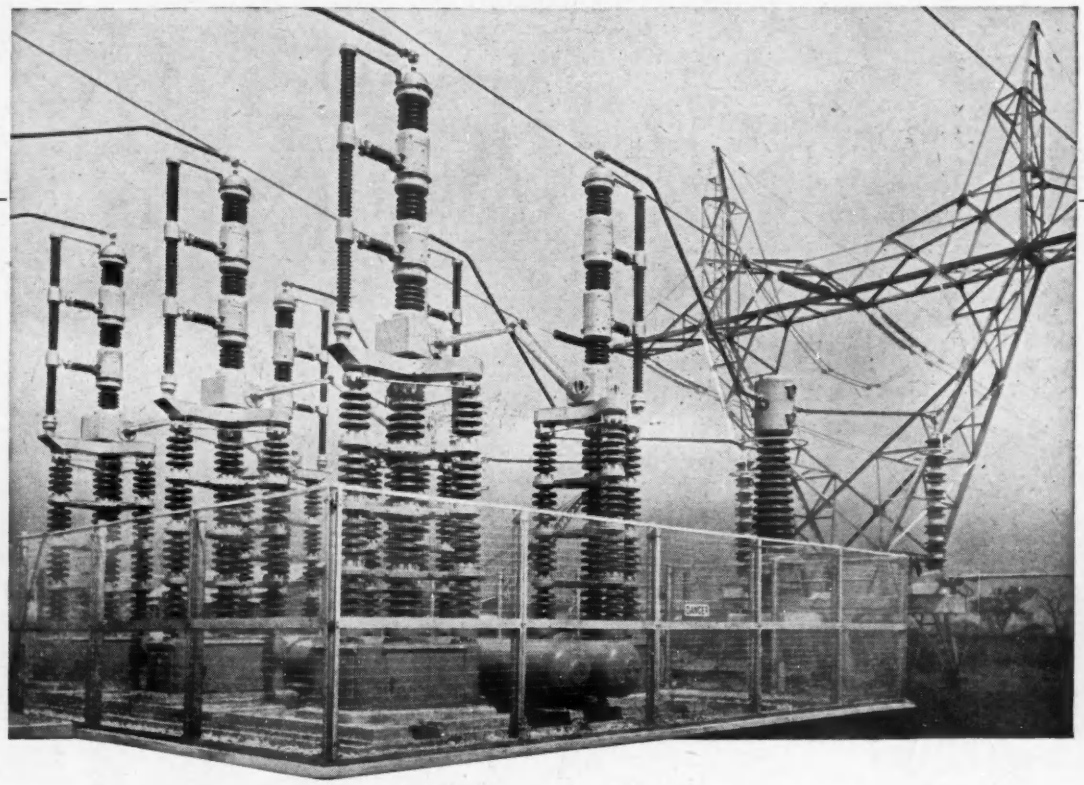
Smee's 13.54

'ENGLISH ELECTRIC' *air-blast circuit-breakers*

for service at

275,000/300,000 volts



The illustration shows the 275/300 kV 7500 MVA air-blast circuit-breaker in service at West Melton, controlling the first section of the British Electricity Authority's 275/300 kV system, namely the line to Staythorpe.

This equipment was commissioned nearly eighteen months ago and in the normal course of its duties the breaker switches the transformer magnetising and line currents. These switching operations have been carried out with low values of transient overvoltage and operation has been entirely satisfactory throughout the period.

'ENGLISH ELECTRIC'

switchgear

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Switchgear Department, Stafford.

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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It tells of the link between J. & P. and oil . . . but it does not tell *why* J. & P. are concerned with so many of the great oil projects.

It is not merely that our range of products enables us to undertake complete electrification schemes. It is not merely that the quality of our products is second to none. But in 1922 we did the first electrification scheme at Abadan . . . and ever since we have been gaining more and more experience. That is why J. & P. are associated with the world's progressive industries as specialists in the transmission, transformation, and control of electricity.

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A PICTURE THAT NEARLY TELLS ITS OWN STORY

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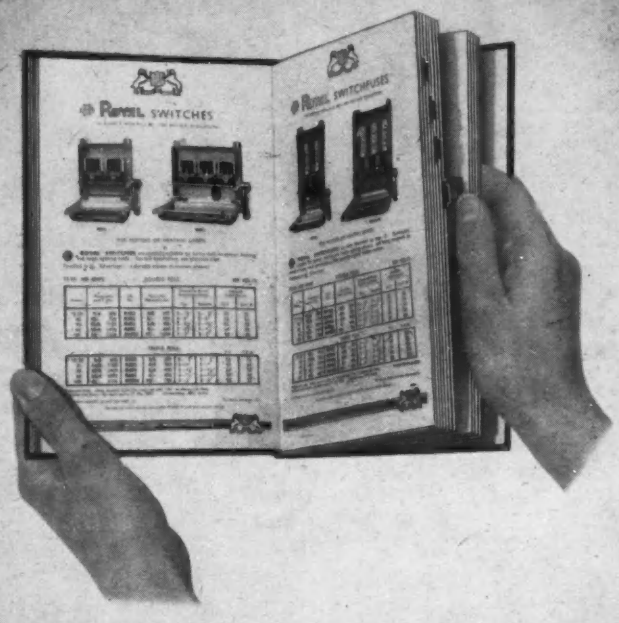

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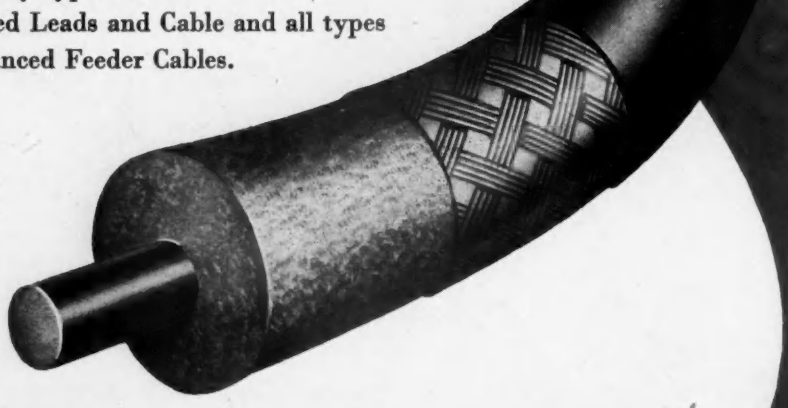

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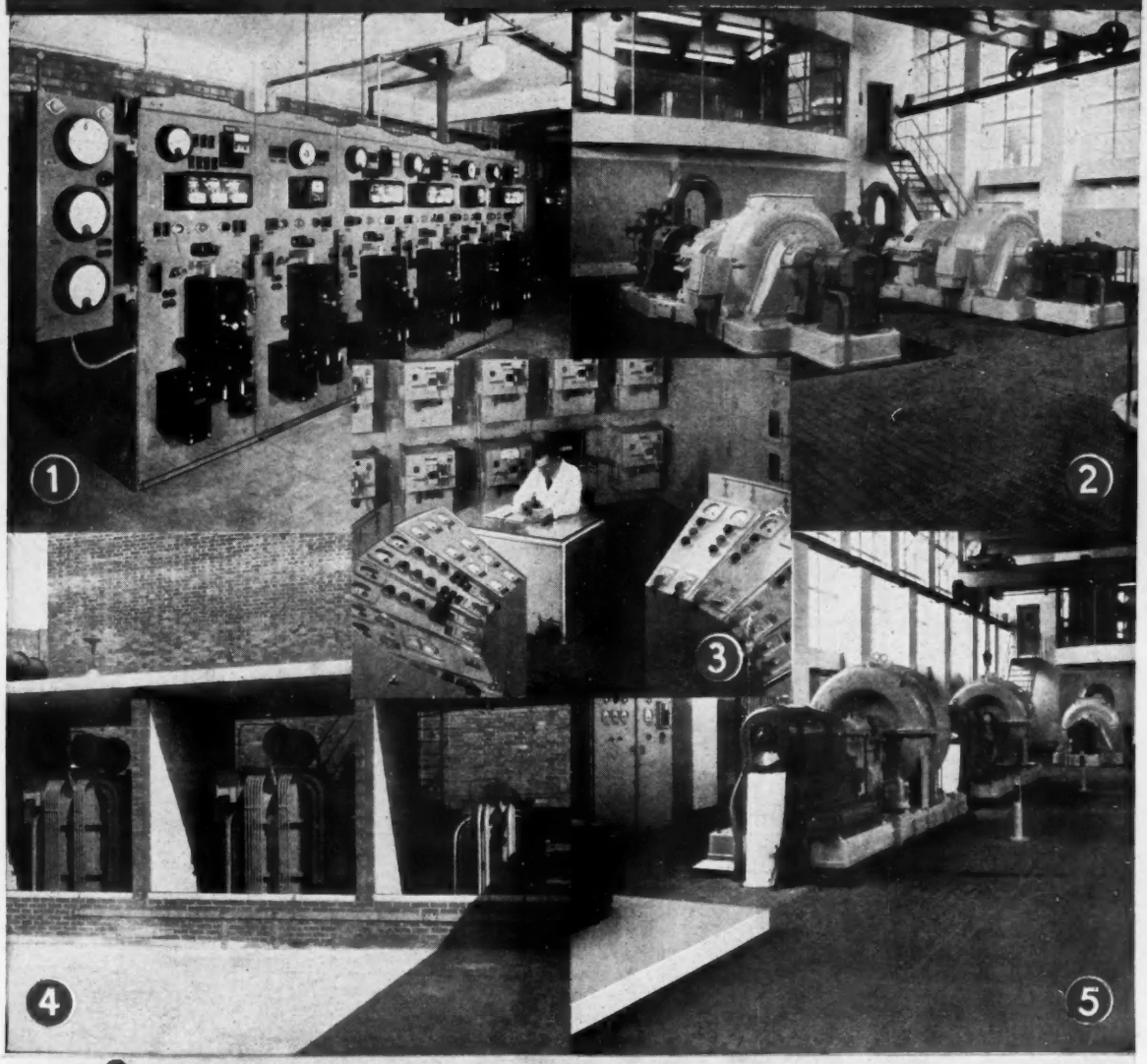

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2 BACK PRESSURE TURBO-ALTERNATORS, 1750 kVA CAPACITY
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4 POWER TRANSFORMERS—4000 kVA TOTAL CAPACITY
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ESTABLISHED 1882

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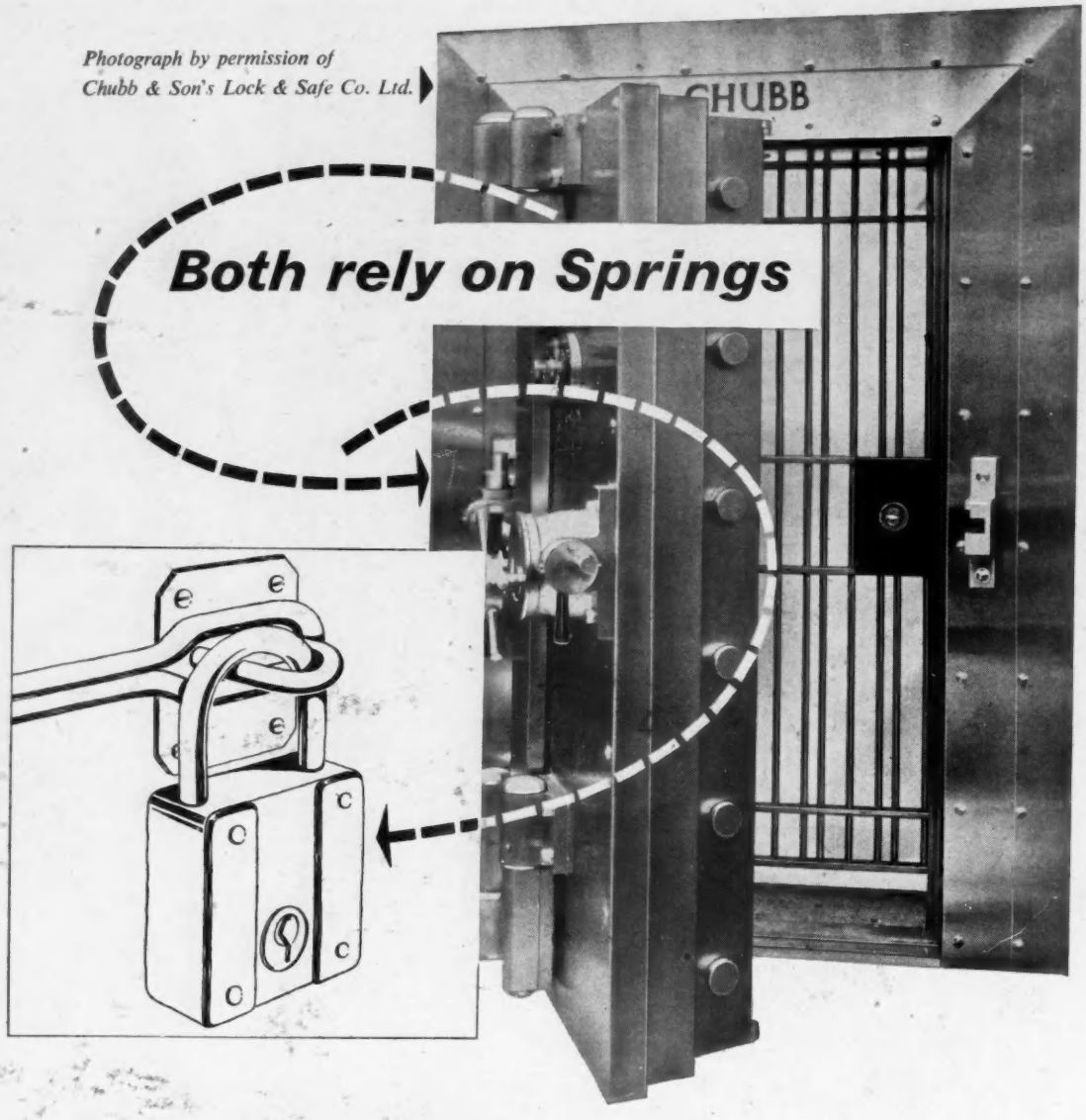
Manufacturers of Rotating Electrical Machinery, Switch and Control Gear, Rectifiers and Transformers.

Photograph by permission of Chubb & Son's Lock & Safe Co. Ltd.



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From the high precision spring required for a strongroom door to its simpler counterpart in a padlock, the right spring for the job is essential to ensure perfect performance. When your springs are designed and made by Salter, they are just right — not the cheapest obtainable but fit to work for ever.

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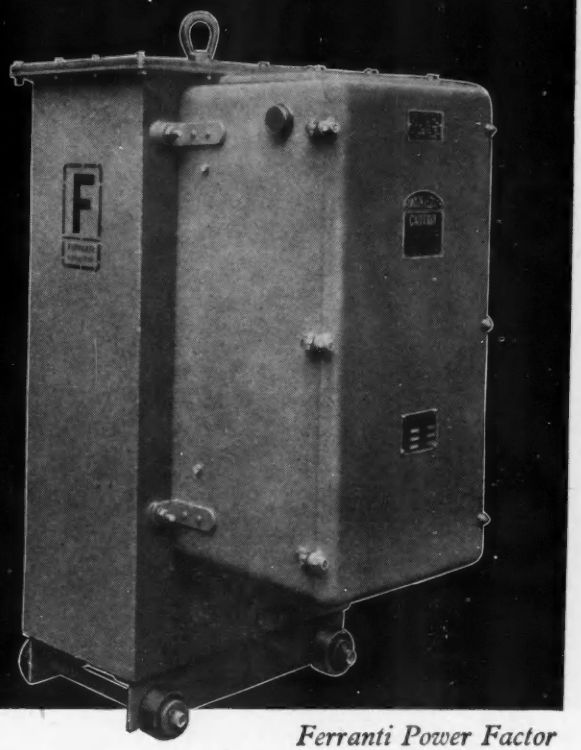
POWER FACTOR CORRECTION CAPACITORS

Two ways of cutting electricity power costs



Ferranti Power Factor Correction Capacitor

MAXIMUM DEMAND ALARM

Ferranti Maximum Demand Alarm

If you are concerned by the rising cost of electrical power in your works, investigate these two sound methods of cutting power costs. First improve the overall 'power factor' of your plant by installing a Ferranti Power Factor Correction Capacitor, and so making effective use of ALL the current you pay for. In most works this device will recover its capital cost in one year.

The Ferranti Maximum Demand Alarm gives advance warning as your load rises to the point of maximum demand (beyond which you pay dearly) and enables steps to be taken to reduce load in good time. Complete information on request.

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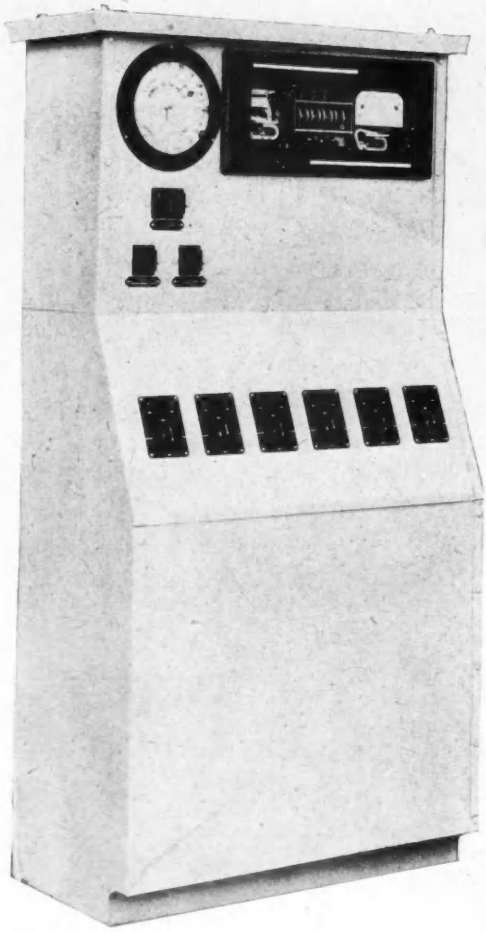
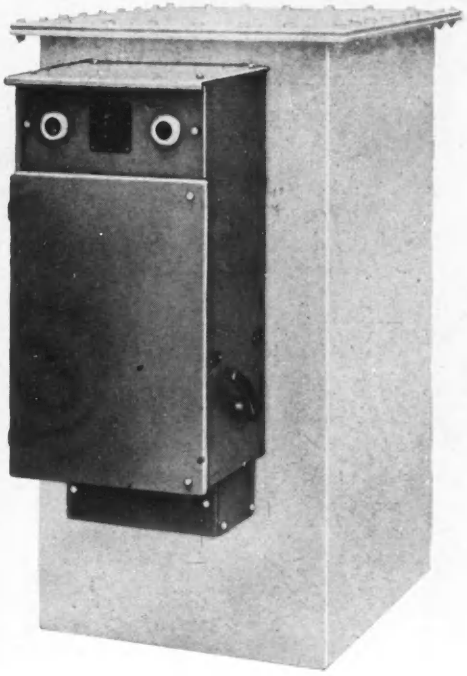
POWER FACTOR IMPROVEMENT

SPECIFY *BELMOS* CONTROL PANELS

when ordering CAPACITORS





BELMOS STANDARD CONTACTOR UNITS
with all desirable protective features, are suitable for capacitor or separate mounting.

A BELMOS CONTROL DESK
ensures that the required power factor is automatically maintained.

BELMOS CONTROL GEAR
is being specified as standard equipment by an increasing number of capacitor manufacturers.

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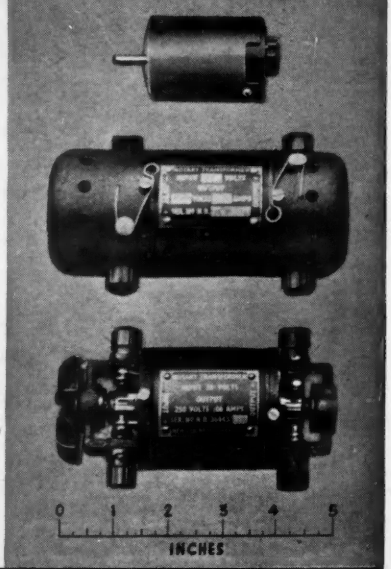
Our Manufactures include :

Aircraft Generators and Motors
Automatic Voltage Regulators
Rotary Transformers
High Frequency Alternators
H.T.D.C. Generators

The illustration shows a small high-speed fractional H.P. motor and miniature Rotary Transformers for "Walkie Talkie" and other RADIO applications.



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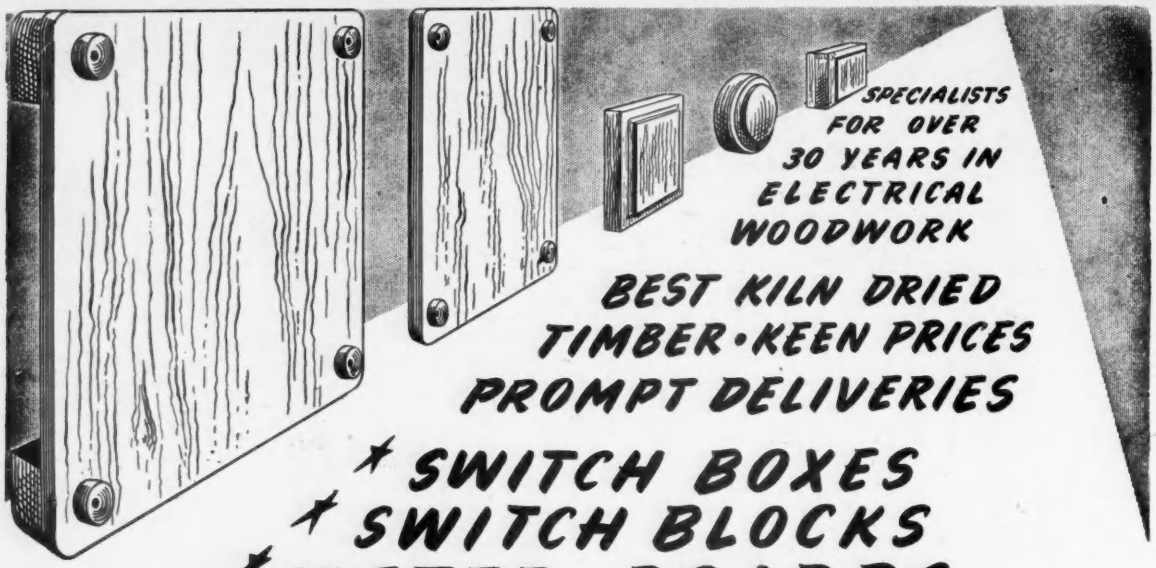
LONDON OFFICE: IMPERIAL BUILDINGS, 56 KINGSWAY, W.C.2



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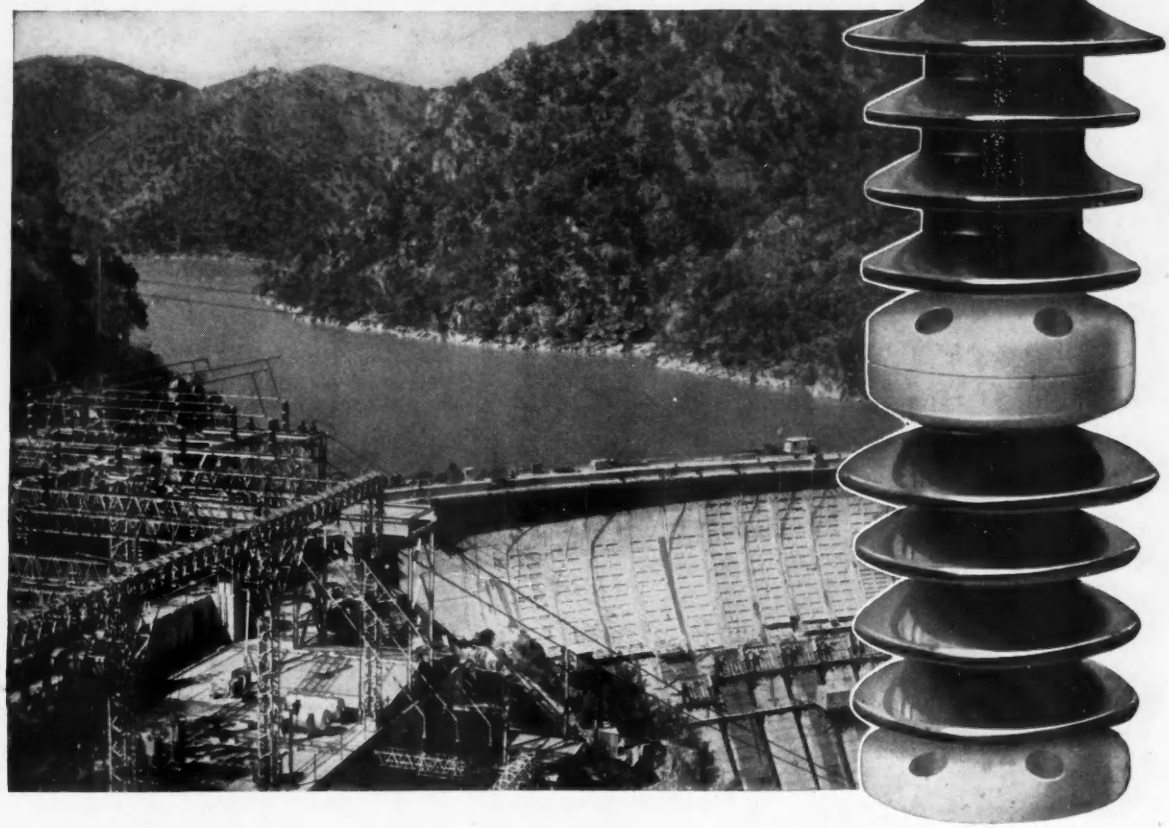
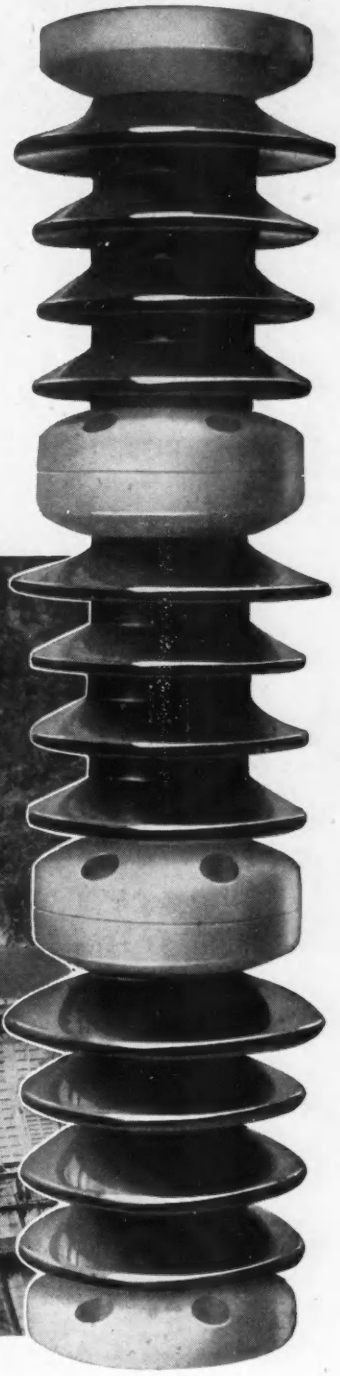
S.P.P. INSULATORS IN SERVICE

Cylindrical Post Insulators in New South Wales





The Burrinjuck 132 kV. switching station was equipped with Cylindrical Post Insulators type P.703. This is one of many stations on the New South Wales Public Works Department system equipped throughout with S.P.P. Post Insulators for 132 kV., 110 kV. and 66 kV.

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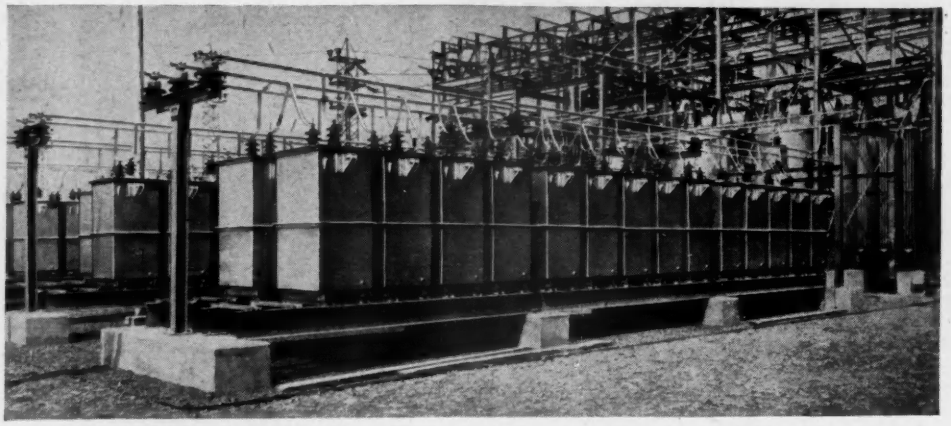
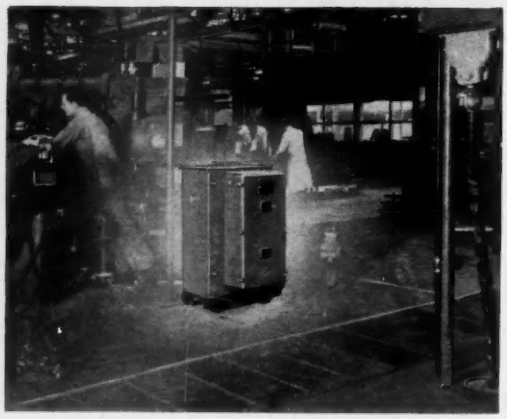
Stourport-on-Severn, Worcestershire. Telephone: Stourport 111. Telegrams: Steatain, Stourport



POWER SUPPLY UNDERTAKINGS This bank of BICC capacitors was supplied to the order of the Aluminum Company of Canada Ltd., and is installed on the system of the Shawinigan Water and Power Co. Ltd. It comprises eighty-one 250 kVAr tank-type units, giving a total output of 20,250 kVAr at 10,300 volts. Several banks of up to 15,000 kVAr have been installed on this and other Supply Systems in Canada.



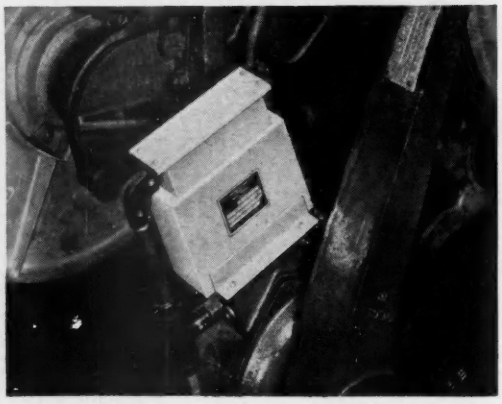
INDUSTRIAL INSTALLATIONS Where individual correction of motors is not possible, automatically controlled capacitors connected to distribution boards result in improved voltage regulation and reduction of load on factory networks. Illustrated is a 50 kVAr automatically controlled BICC capacitor in an aircraft factory in the North of England.

for Power Factor Improvement

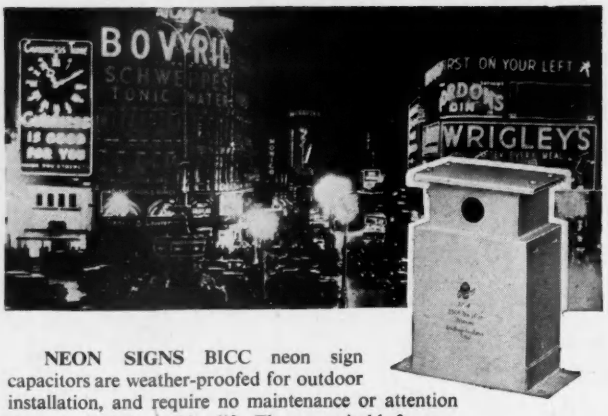
use **BICC**

CAPACITORS

If you are interested in power factor improvement, BICC can supply the equipment best suited to your individual need. We have been producing capacitors of all types for more than 40 years. During this time continual improvements have been made in design and performance so that today we can guarantee an efficiency of 99.87 per cent for capacitors: i.e. losses do not exceed 1.3 watts per kVAr. We shall be pleased to discuss your requirements with you or send you appropriate literature on request.



LOOM MOTORS Many thousand kVAr of BICC capacitors are now in use in mills throughout the country. The illustration shows a ½ kVAr capacitor mounted directly on a ¾ h.p. loom motor in the Woodbine Mills of Thomas Walton Ltd., Burnley.



NEON SIGNS BICC neon sign capacitors are weather-proofed for outdoor installation, and require no maintenance or attention throughout their working life. They are suitable for continuous duty on single-phase a.c. circuits up to 250 volts.

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When daylight fades...

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1-80 h.p. motors by BRUSH

this range they'll have the answer at Cardiff: slipring or squirrel cage, conforming to BSI, CSI or NEMA standards. And if yours is a case for a 'special', it may already be among our existing types. If not, we shall be pleased to consider your particular requirements. Write for full details and Publication No. 11002.

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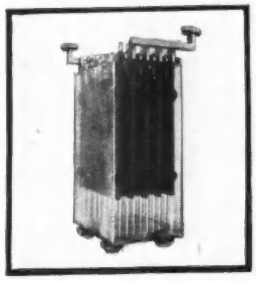
POWER IN STORE

(An artist's impression of the Brunswick Wharf Power Station at Poplar.
Consulting Engineers: JOHN BRUCE & PARTNERS.
Consulting Architects: FARMER & DARK, F/F.R.I.B.A.)

The Ediswan battery installations at the Brunswick Wharf Power Station control all switch tripping and closing. The large battery illustrated supplies current for switch-closing, emergency lighting and D.C. motors. Four smaller batteries (see below) provide for the operation of air-blast and oil-circuit breakers, panel indication lamps and telecommunication equipment.



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Who can doubt it? Even so, the finest timepiece may occasionally be in need of repair. Similarly, faults can develop in the best conceived system of electrical wiring. And much inconvenience it causes when cabling is housed in barrel conduit of the ordinary type. CHANNEL CONDUIT, on the other hand, makes the overhaul of faulty circuits a routine task—for the patented capping *springs* off without difficulty, allowing quick access to the wiring layout. Rust-resisting and vibration-proof, CHANNEL CONDUIT costs less to buy, install and maintain than any other form of trunking. It is extensively used by Industry and Government Departments. Sizes stocked range from 4″ × 4″ to 1″ × ½″, and full details may be had by requesting a copy of pamphlet No. R.A.25.

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LOW VOLTAGE LIGHTING TRANSFORMER.
In die cast Aluminium Case. Self isolating, fitted with D.P. on-off Switch & H.R.C. Fuses to B.S.S 794/38. Can be supplied with 1, 2, or 3 arm Lighting Brackets or Low Voltage Plugs & Sockets.

MEDIUM VOLTAGE ALL INSULATED TEST LAMP.
100-500 Volts. AC. DC. Fitted with H.R.C. Fuses in each prod.

PORTABLE TRANSFORMERS.
For portable m/c tools, hand lamps, etc., Secondary Voltages from 12 V—110 V. Capacities from 50 V.A. to 750 V.A.

LOOPMETERS.
For testing earth fault loop resistance—2 models available.

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B

P & G is on his track!

He comes up to town on the 8.15 in the morning and catches the 5.20 for home at night. But what he does not know is that P & G is watching over him. For P & G Batteries provide the current for switchgear operation and supervisory control on his railway line. The 60 years of P & G experience cover a vast and varied field in electricity supply—including batteries for generating stations and substations, railway electrification work, emergency lighting, telephone electricity supply. If you have a project, discuss it with our specialists. Our 3-point service covers (1) Technical Advice and Specification (2) Equipment and Installation (3) Regular Inspection and Report.

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for

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SWITCH TRIPPING

EMERGENCY LIGHTING

STANDBY POWER SUPPLY

SUPERVISORY CONTROL

Pritchett & Gold and E.P.S. Co. Ltd

BATTERY MAKERS SINCE 1882

137 VICTORIA STREET · LONDON · SW1 PG22A

SPARTAK play under REVO FLOODLIGHTS

Russian players train at Tipton

Because of the excellent facilities provided by the Revo Electric Company's Floodlit Sports Arena at Tipton, the Russian Spartak team selected this ground to carry out their training (in preparation for their match with Wolverhampton Wanderers) and found the lighting to their entire satisfaction.

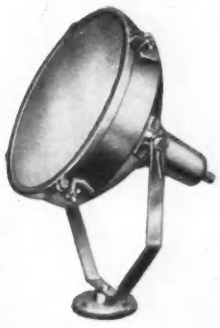
The experience of close on half a century in the manufacture and design of lighting equipment enables the Revo Electric Co. Ltd., to offer a first-class service and many leading clubs throughout the country have chosen Revo Floodlights to illuminate their grounds.

The company's technical staff is available to advise on all aspects of floodlighting and details and catalogues will gladly be sent to interested authorities who are invited to forward their enquiries without obligation.

(Top) Wolverhampton Wanderers playing Revo Electric Co. Ltd., on the latter's own ground.

(Centre and below) Members of the Russian team taken during their training under Revo Floodlights.

REVO REGD. **FLOODLIGHT EQUIPMENT**



REVO ELECTRIC CO. LIMITED, TIPTON, STAFFS, ENGLAND

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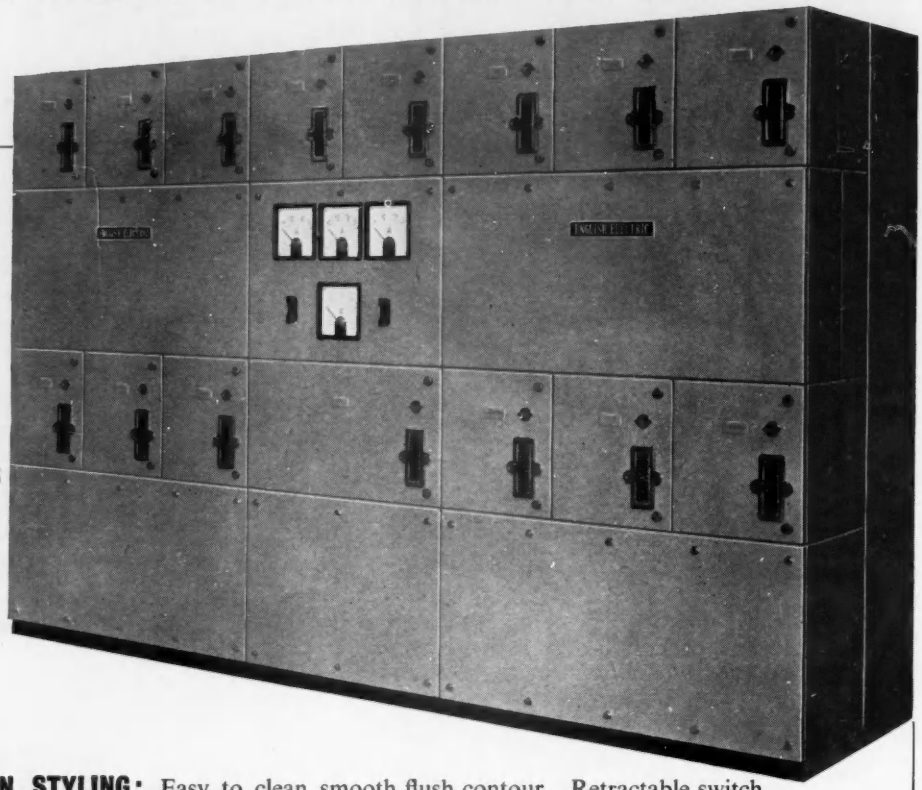
Incorporating H.R.C. CHASSIS TYPE FUSE-SWITCHES in ratings up to 750 amps.



MODERN STYLING: Easy to clean smooth flush contour. Retractable switch operating handles.

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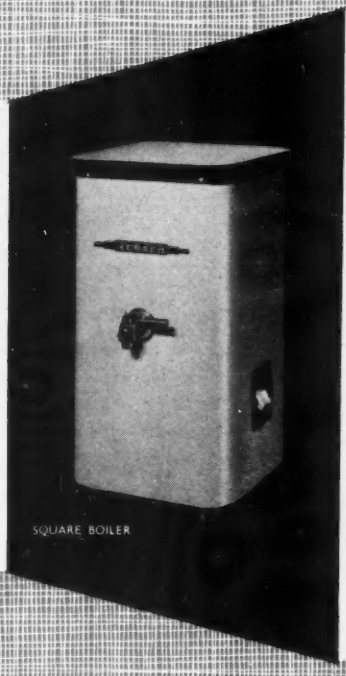

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STREET LIGHTING

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Automatic

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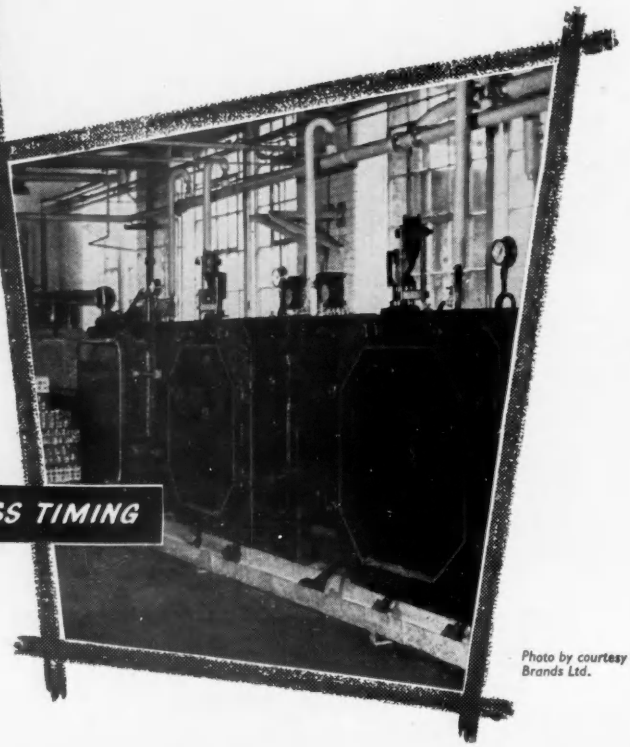

PROCESS TIMING

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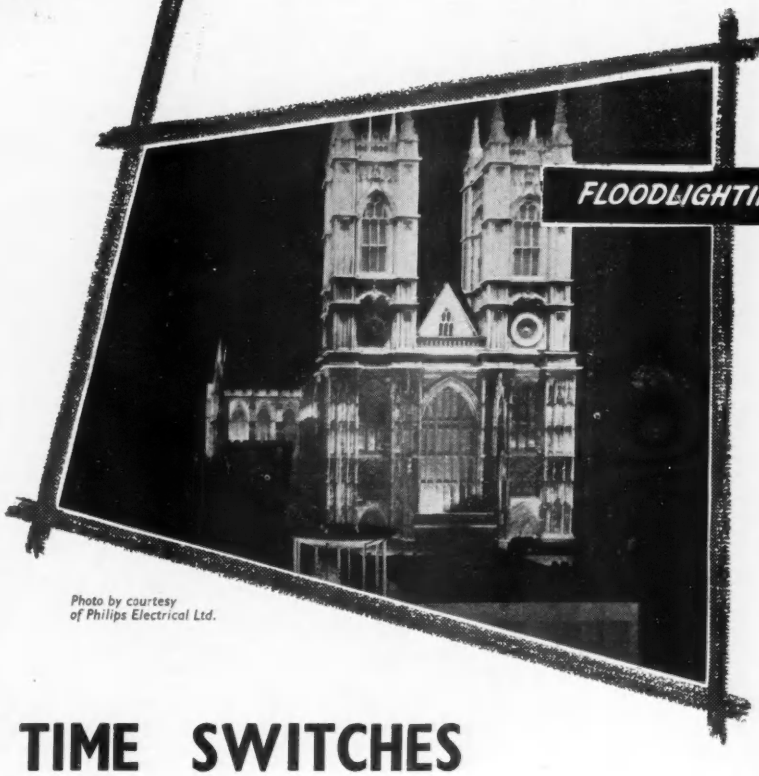

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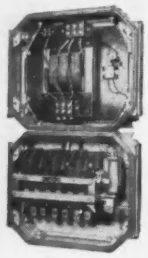
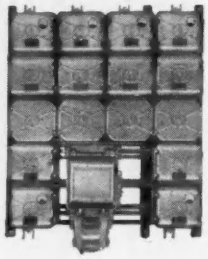
'MARKS A NEW ERA IN FACTORY PROTECTION' Refer to Page 22 "Electrical Accidents and their causes 1952" M o L Form 929.



A triple pole 30 amp. Circuit Breaker with core balance transformer and E.L. relay



A typical multi-way 15 amp. board with instruments. Individual panel isolators also available.

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UNIQUE for its Core Balance Leakage protection.
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BUILT TO BRITISH ELECTRICITY

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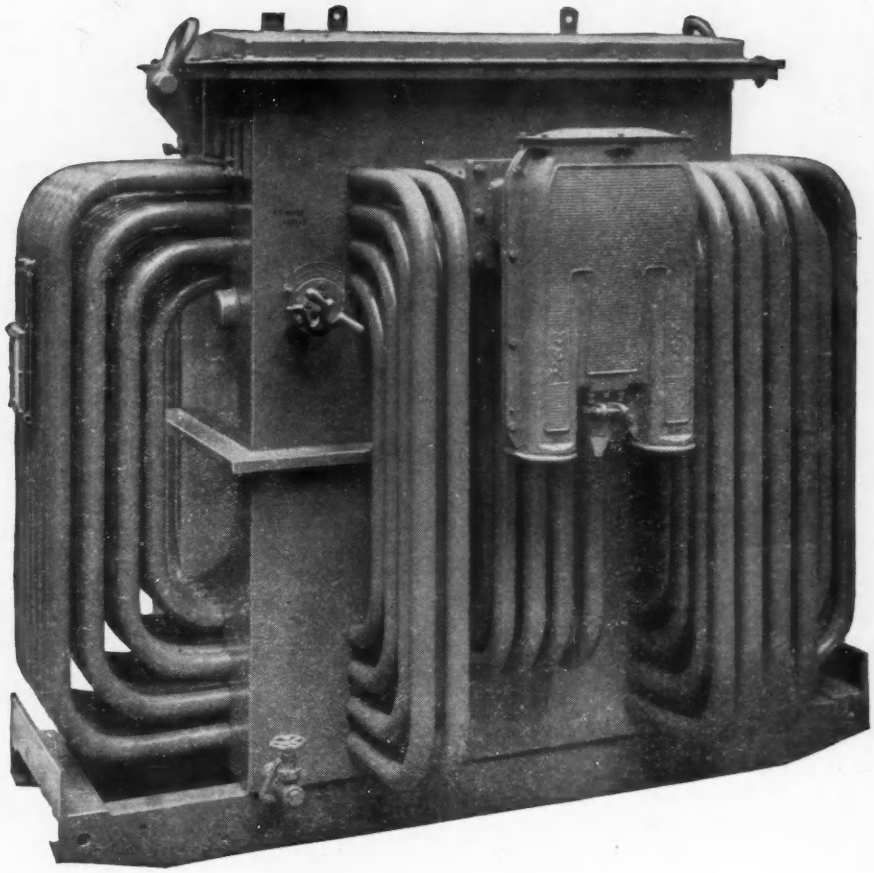

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THREE POLES IN ONE TANK AT 110/132 kV

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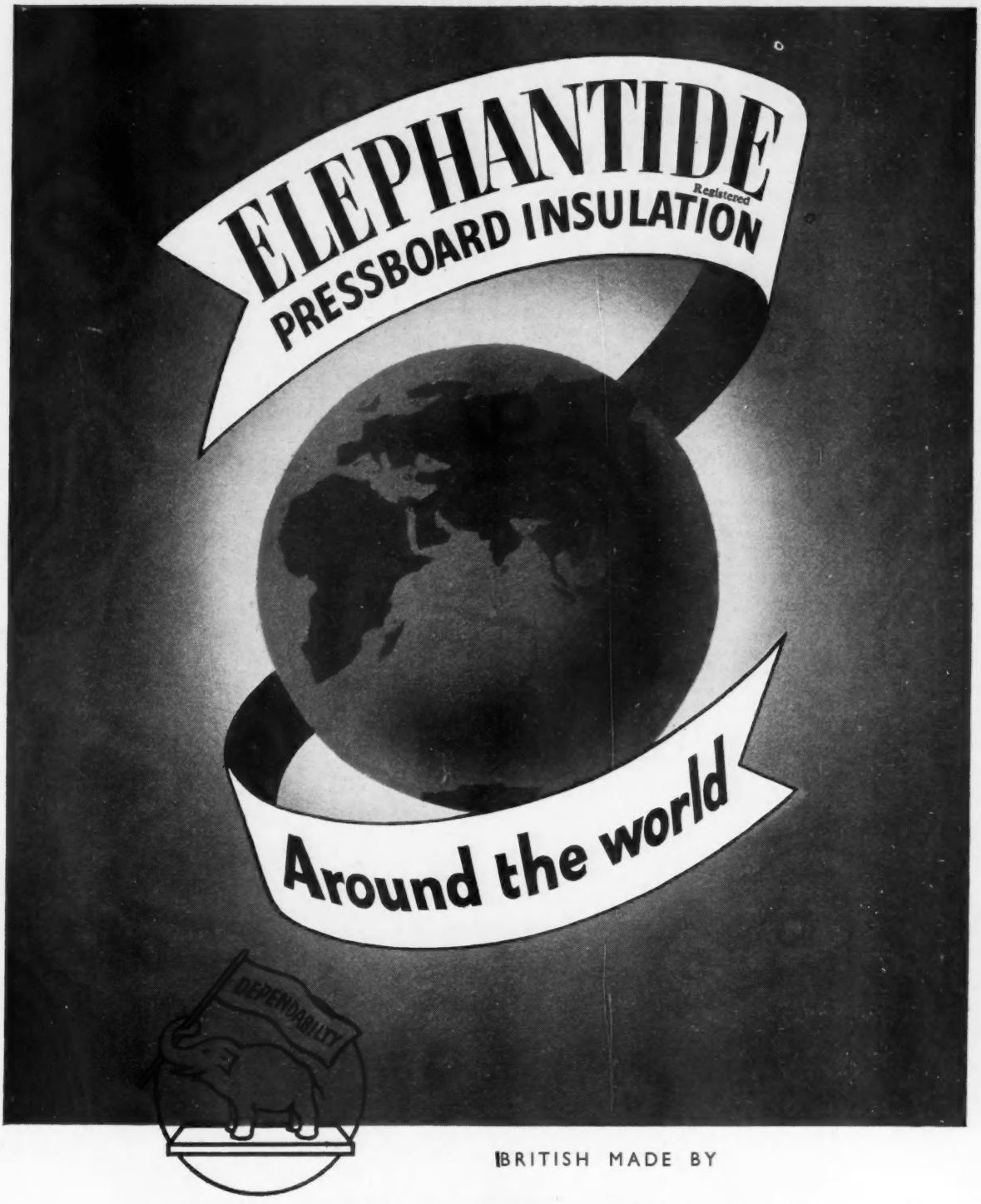

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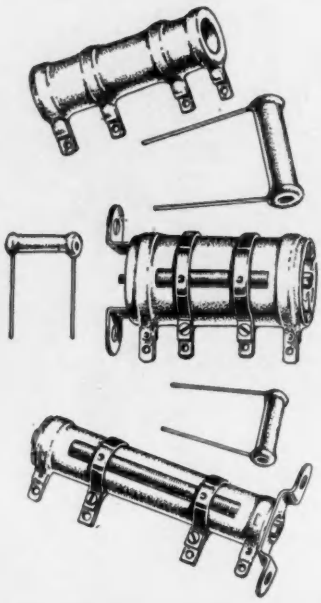

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Fuses incorporated
Very fine adjustment of voltage
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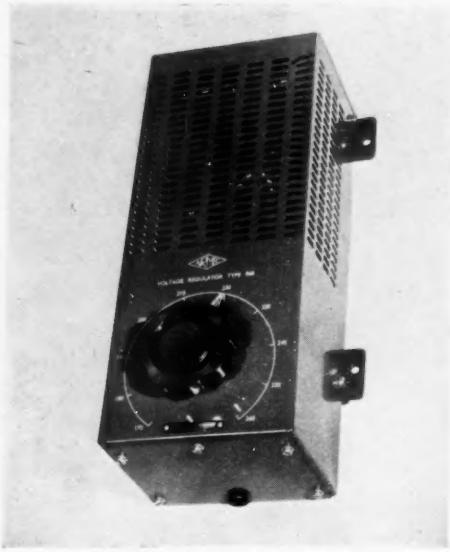

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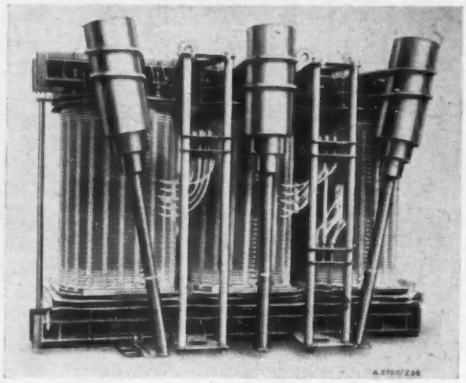
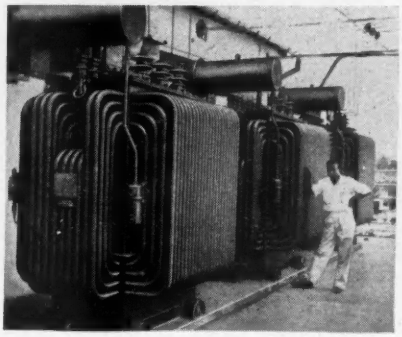


Specification Story



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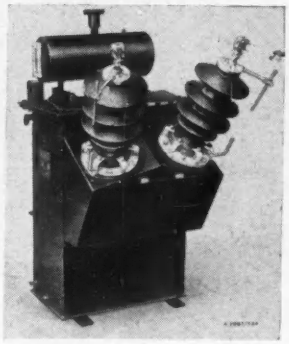
1 *Eight 150 and 250 kVA transformers on test.*

2 *5,000 kVA transformer (Core & windings high voltage side) 3 phase, 50 cycles, 132/66/33 kV.*

3 *Three 1,250 kVA transformers installed at a paper mill in India, 3 phase, 50 cycles, 13,200/400 volts.*

4 *25 kVA pole mounting transformer single phase, 50 cycles, 33,000/240 volts.*



When every high-voltage transformer made today conforms to fixed standards of construction and performance, why do so many engineers prefer those made by BRUSH?

The answer is that British Standards and all other specifications are only a part of the story. BRUSH have their own special standards; rigid and exacting standards of design, workmanship, reliability and service after installation.

The result: BRUSH transformers offer a double guarantee during their whole life—which (as the BRUSH service department will tell you) can easily be 40 years or more.

Transformers by **BRUSH**

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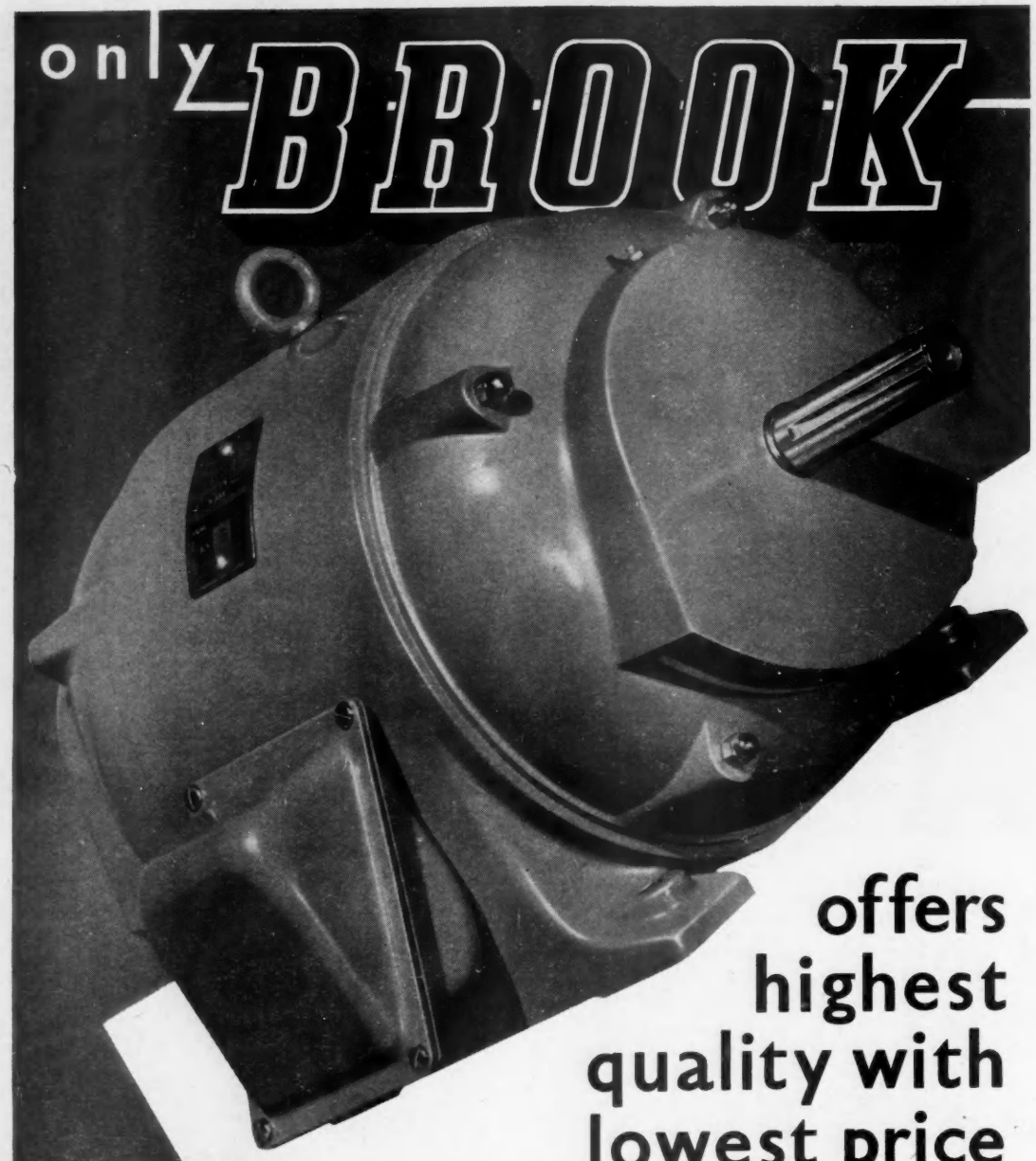

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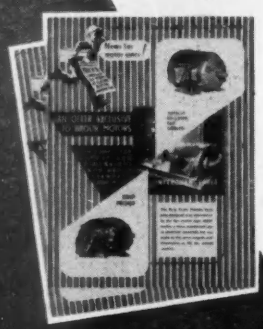

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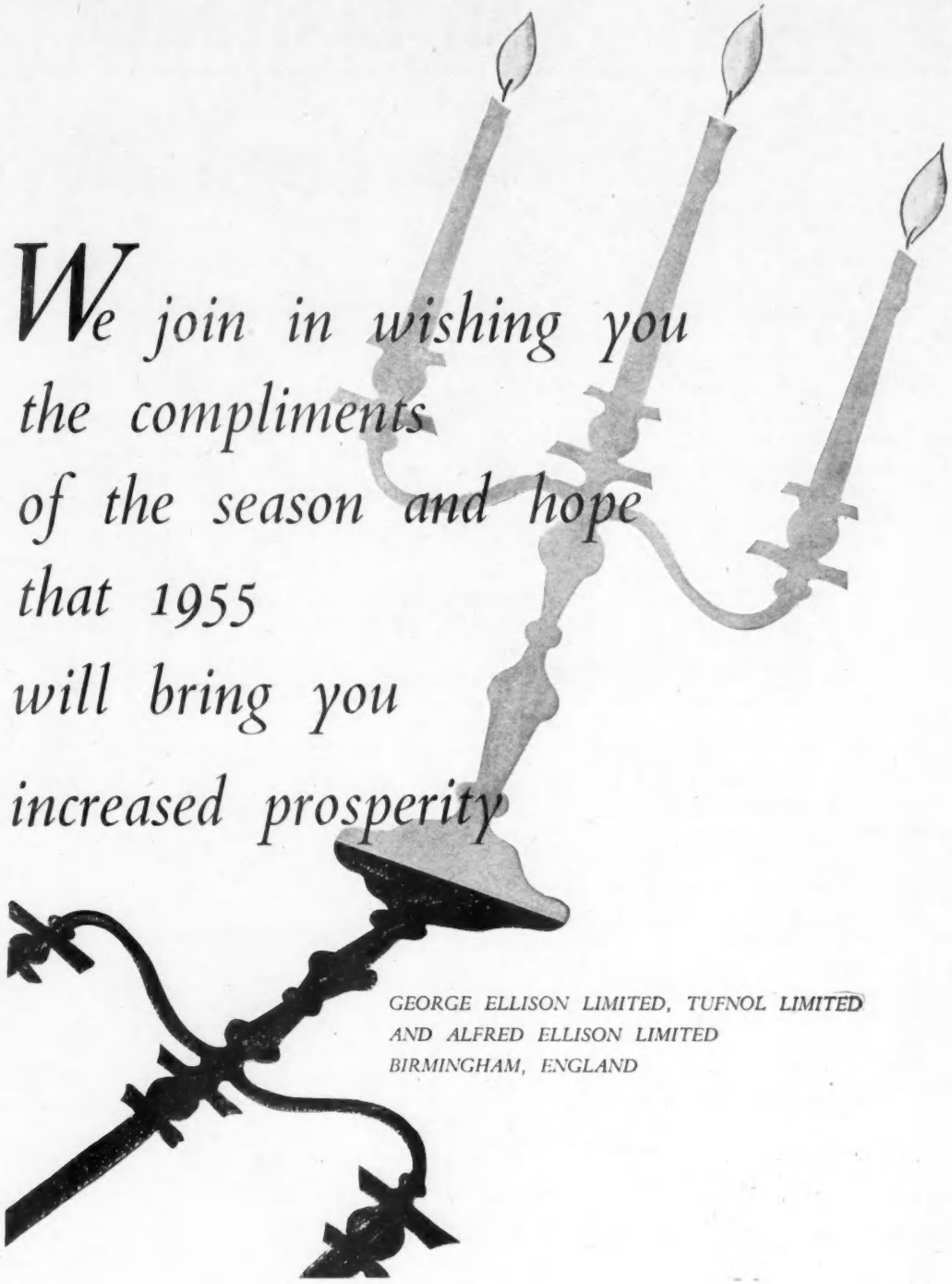

We join in wishing you the compliments of the season and hope that 1955 will bring you increased prosperity

GEORGE ELLISON LIMITED, TUFNOL LIMITED
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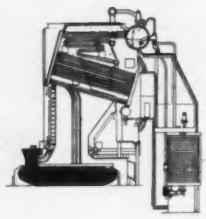

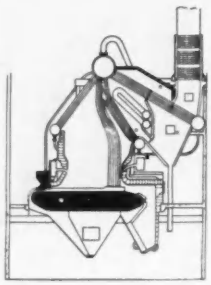

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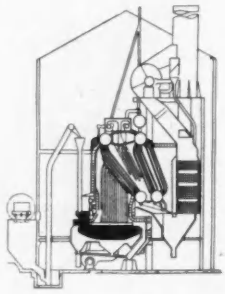
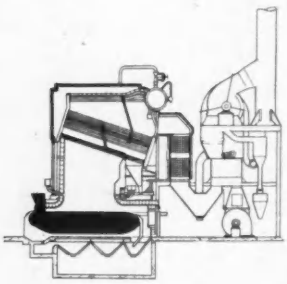
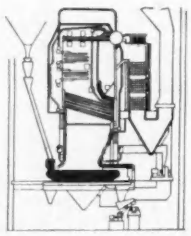
For every known design and size of water-tube boiler there is a highly efficient 'L' type travelling grate stoker.







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L *Burns efficiently any fuel from refuse to anthracite*

L *Remarkably low maintenance, with parts requiring attention easily accessible*

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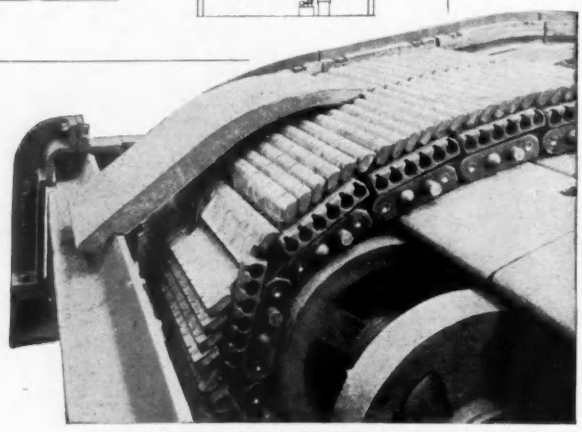

View of the rear end of an 'L' type travelling grate stoker

The result of Enterprising Engineering by IC

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 23 DECEMBER, 1954
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DANGERS OF TEST DAMAGE

The old controversy as to the reasonable extent to which large electrical plant should be works tested prior to despatch was brought up yet again last week when a paper was presented to the I.E.E. on the short-circuit testing of alternator end-windings. In their argument, the authors quoted a specific case where a 60 MW alternator, after preliminary testing was excited to full voltage and a short-circuit applied solidly to all three phases. The machine failed subsequently to withstand the normal high voltage tests, due to breakdowns on each of the phases. The significant point made was that had the operating voltage been 13·2 kV instead of 13·8 kV, and the same short-circuit test applied, it might have been possible for the faults on two of the phases to pass the high voltage test undetected and for the machine, after repairs to the third phase, and further voltage tests, to have been shipped in a damaged condition. It is precisely this type of possibility which has led to the demand on the part of several manufacturers for type-testing of large machines, followed by short-circuit tests restricted to 75 or 50% of full rated voltage. An objection to such testing lies in the present design of end-windings and bracing scathingly referred to by one of those taking part in the subsequent discussion, as consisting of a "make-up of wood, string and paper with part rigid support and part no support." To obtain consistency among machines made from the same drawings as the type-tested unit would require a remarkably high standard of individual workmanship and an exceptionally close control of the quality of materials. Nevertheless, it is fast becoming obvious that some means must be found of testing the larger machines now coming to the fore with a fair guarantee that the tests themselves will not cause fundamental damage. The reduction of practical short-circuit currents in operational conditions, which has been introduced by the use of generator/transformer combinations, may make possible some alleviation of

The Editor and staff wish all readers a Happy Christmas and a Prosperous New Year

full testing requirements, but it is also possible that an *ab initio* attack on the end-winding problem might lead to a much better fundamental design.

E.D.A. TURNS TO INDUSTRY

A trend in the affairs of the Electrical Development Association that has been apparent in the past few years was formally confirmed last week by the appointment of an Industrial Development Committee. This committee will have the duty of finding ways of fostering and developing the use of electricity in industry. For the past four or five years the Association has been giving increasing attention to this topic, and the early post war work culminated in the appointment of a steering committee in 1952, charged with directing activities on industrial electrification and productivity. This Committee reported to the E.D.A. Council that the Association's work should be expanded to comprise an industrial campaign, having the short term object of encouraging industrialists to make better use of existing supplies, particularly in small and medium sized factories; and the ultimate aim of increasing greatly the use of electric power in industry. The results of this policy are to be seen notably in the "Electricity and Productivity" series of books and special films. The appointment of a regular committee should give a new impetus to this nationally valuable work.

GAS WASHING HAS LIMITS

Public debate on the Beaver Committee's report on air pollution has so far concentrated on the controversial question of the removal of sulphur compounds from power station flue gases by various washing processes. The British Electricity Authority have been quickly off the mark with comment on the recommendations put forward, which can have so great an effect on the financial balance of electricity supply. Difficulties in adopting flue gas washing in all power stations have been restated, but their basic disagreement with this section of the Committee's findings is softened by the way in which the B.E.A. pledge themselves to carry out loyally and energetically whatever decisions the Government reaches on the question. It does not seem, however, that the B.E.A. have made as strong a case on the report as they might. Although the recommendations of Sir Hugh Beaver and his colleagues on gas washing are strongly worded, they are hedged around with provisos. Gas washing is desirable, their report suggests, only if it achieves the removal of 90% of the sulphur compounds that might otherwise be discharged into the atmosphere from power station chimneys, and if it adds no more than 0·07d. per unit to the cost of electricity supplied. The B.E.A., in their statement on the question have suggested that the cost of flue gas washing equipment and of a relatively small amount of extra grit arresting plant would mean an increase of 12% in the generated cost of electricity; an increase, in fact, of nearly 0·09d. per unit. There remains the question of efficiency in removing sulphur. Whether 90% will be continuously attainable must remain a matter of conjecture until large scale tests have been completed with the ammonium sulphate producing method of sulphur dioxide extraction; and extension of the process in turn depends on an adequate supply of ammoniacal liquor. The need in the interim period is to keep the provisos in the report fresh in the minds of the public and officialdom.

OLD AND TRUE

1954 has seen the sales effort of electricity board commercial staffs return once more to full pressure. The latest techniques of publicity and generation have been applied to encourage existing consumers to make greater use of their supply, and to persuade both building authorities and individual tenants on new housing estates that electricity is the best medium for cooking and heating as well as lighting. Streamlined modern methods are appropriate for the contemporary problem; and yet, how little change has there been in the basic requirements of successful operation of the commercial side of electricity supply, compared with the pioneering days! Elsewhere in this Christmas number, examples are given of the sales literature that represented latest practice at the end of the nineteenth century. It would not do for today's slicker world. But the staidly worded letter and pamphlet reproduced represented the working out of a precept as appropriate today as in 1900. "Business must be sought in an energetic manner," had written the consulting engineer of the Stepney undertaking, the redoubtable Arthur Wright and, he went on, "not merely left to develop itself under the impression that the natural advantages of the electric light are sufficiently well known as to do away with all necessity of having actively to push the undertaking." Since the supply industry has been free once again to seek business in "an energetic manner" sales have increased in an encouraging degree. The rate of increase of electricity consumption has soared to most promising levels.

ELECTRONICS AND THE "E.T."

One of the many new fields in which electronics is making progress is that of the production of printing blocks. In some ways this is a logical development of picture telegraphy with its scanning of the photograph to give a reproduction of the picture in electrical impulses. The second stage in the building of an electronic engraver, is the production of a cutting head actuated by this current, which will cut or burn plastic sheet in a series of dots, the size of which follow the tonal values of the original photograph. In addition to our technical interest in this new development, we have a stake as a user of a large number of printing blocks. For some months now we have been regularly using these electronically etched blocks and as the first magazine in this country to use fine screen blocks of this type, we have had to meet some of the teething troubles. However, as a result of our experience, we are convinced of the importance of this new electronic method for high speed work of the type demanded by a weekly newspaper. The method has certain limitations and is not suitable for the reproduction of all types of photos but these early electronic engraving machines demonstrate the practicability of the method and offer the possibility of outstanding progress in the near future.

Meteor

LOOKING BACK

F. J. HALLIGEY, A.M.I.E.E., A.M.(S.A.)I.MECH.E.

reflects on some wartime experiences

A STORY recently published, describing the re-insulation by hand of short lengths of copper winding wire for vehicle generators during the war, reminds me of several experiences I had while in charge of a South African mobile Signals workshop in Italy during the years 1943/45. Anyone who served with such a unit will know that, except in the very late stages of the conflict, we did not have really adequate equipment (that is, in our own opinion), while the stern pages of the War Establishment Tables denied us the remedy of drawing equipment, additional to that authorised, from Ordnance Depots. We made the best use of what we had; and we were usually on the lookout for more.

Transformer Winding

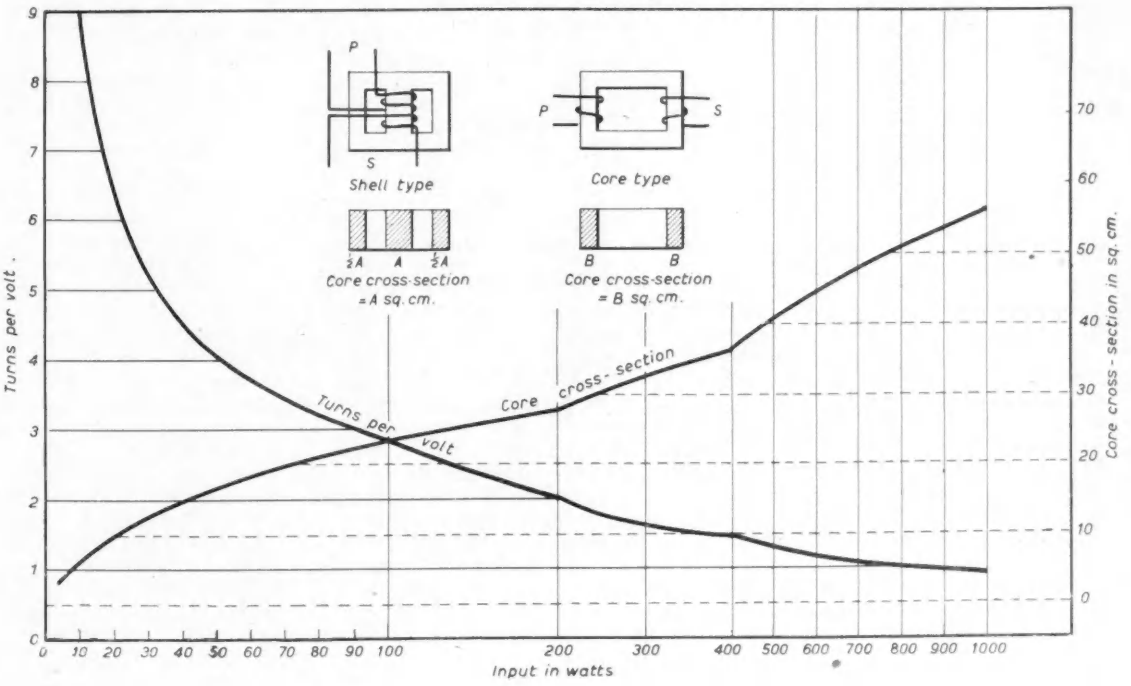
A Signals workshop unit experienced a constant demand for the construction of small power transformers for operation in conjunction with radio apparatus and the like. Ordnance Depots could supply reasonable quantities and varieties of winding wire, but not core laminations. We were able to secure laminations by means of stripping apparatus from salvage dumps, but we could not form any opinion regarding the quality of the iron; and furthermore, we were not winding specialists. On some occasions we even used tinplate cut into strips.

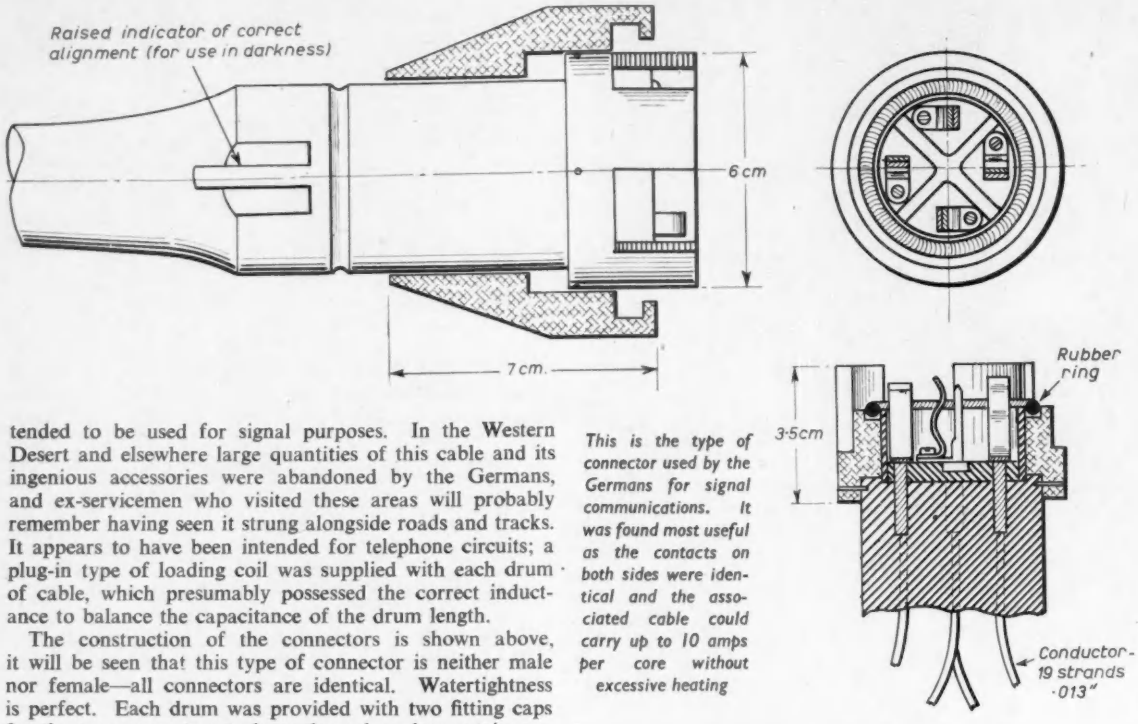
Over a long period we were able to determine safe winding formulae (not necessarily of the optimum electrical efficiency), and the accompanying curves (Fig. 1) were prepared for use when the quality of the laminations was unknown to us. These curves may still be of interest to those who wish to wind odd transformers. It will be noticed that the curves are not straight lines—the magnetic efficiency of the cores decreases with smaller sizes in which the joints are relatively more imperfect, and where the lamination thickness expressed as a fraction of the core thickness is greater than in the larger sizes. Incidentally, these curves do not apply to transformers intended for use with "vibropack" units—the vibrators do not generate a sine wave and allowance has to be made for the appropriate form factor.

Plug and Socket Connections

One essential requirement for a mobile workshop is mobility, and this includes the ability to pack up, move, and resume operations in the shortest possible time. The equipment in our workshop vehicles required a supply of electricity for motive power, instrument testing, and lighting, and we were considerably helped in this respect by the acquisition of German field quad cable. This was a 4-core T.R.S. cable fitted with special connectors and in-

Curves derived for winding small transformers using salvaged laminations where the quality of the iron is unknown. The type of transformer concerned is "shell" and is for operation at 50 c/s. For core type transformers the same curves can be used except that the core area must be halved and the turns/volt doubled





This is the type of connector used by the Germans for signal communications. It was found most useful as the contacts on both sides were identical and the associated cable could carry up to 10 amps per core without excessive heating

tended to be used for signal purposes. In the Western Desert and elsewhere large quantities of this cable and its ingenious accessories were abandoned by the Germans, and ex-servicemen who visited these areas will probably remember having seen it strung alongside roads and tracks. It appears to have been intended for telephone circuits; a plug-in type of loading coil was supplied with each drum of cable, which presumably possessed the correct inductance to balance the capacitance of the drum length.

The construction of the connectors is shown above, it will be seen that this type of connector is neither male nor female—all connectors are identical. Watertightness is perfect. Each drum was provided with two fitting caps for the two connectors to keep them dry when not in use.

In spite of the fact that the cable was apparently designed only for signal currents, it worked very well for lighting and small power distribution, and so did the connectors. The cross section of one cable core was ·0147 sq cm, and the contact area of one contact in the connector was about 0·75 sq cm. A current of 10 amps per core could be handled without excessive heating. We found that if the loading coils were removed from their double connector, the resulting hollow aluminium cylinder having a connector at each end could be cut in half, and would then serve as power outlets or inlets when fixed to the outside of vehicles. Single lengths of cable could be plugged from one vehicle to another, or they could be plugged into one another to make lengths as long as necessary. An army of cut-in-half loading coil cases fitted to a panel on the side of the power vehicle served as the main distribution point, and the whole workshop could be connected up and be ready to operate in a very short time after pulling into position.

Three-phase to Single-Phase

On one occasion when we were billeted near a brick and tile works, we took the opportunity to acquire a motor for one of our lathes. A 220 V 50-cycle single-phase supply was available from our own power plant, but the few unsabotaged motors which remained in the works were all three-phase machines. We selected a 1 h.p. three-phase six-pole motor which had 36 stator slots. The windings were carefully removed—fortunately they were not solidly baked in—and then the wire was re-wound in 32 of the slots to form a four-pole single-phase motor as shown in the diagram on the following page.

With the addition of a 60 mfd. capacitor secured from the works power-factor improvement scheme, and with two rotary switches which we had on hand, this formed an excellent reversing lathe drive. If I remember correctly, the drive was via a countershaft for which hardwood pulleys and plain unbushed hardwood plummer blocks were turned up and found to serve adequately.

A Welding Transformer

We were not supposed to have a welding plant on strength, but the acquisition of a "liberated" potential transformer from a salvage dump gave us the idea of using it to build a welding transformer. The core appeared to be about the correct size for 5 kVA, but none of us knew very much about the design of such a unit as regards the secondary (welding current) winding, although the primary winding did not seem to present any obstacles. The core was therefore taped (with tape, marker, minefield, 2 in. wide) and wound for a 220 V supply.

We took some time to decide what would be the best secondary conductor, and guessed that the open circuit voltage should be about 40. Eventually someone picked up a length of three-core paper cable, approximately 0·15 sq ins. cross section. One core was separated out, the paper stripped off, and it was taped, painted with shellac, and wound on over the primary. When this arrangement was tried out (numerous interested onlookers being present) the result was nil. Not only was no arc produced, but a voltmeter across the secondary terminals registered zero. This apparent suspension of the laws of electro-magnetic induction gave rise to much furious thought, until it was conceived that we had built a transformer with normal primary but with a secondary composed of numerous windings in parallel, more or less insulated from one another by the cable compound, and probably of slightly varying impedances. This variation was apparently sufficient to counteract the open circuit voltage completely, although no doubt circulating currents were set up in individual strands.

So matters rested for some weeks, until the unit moved to a town where a tramway system had once run. The trolley wires were now, however, lying in tangled masses alongside the roads. We collected a short length of 50 feet or so, noted that it was very hard, and annealed it by stretching it out on the ground and building a fire of small twigs along its length. We then taped it up and wound it on the transformer in place of the cable core. This time

there was no argument—an adequate arc was struck and electric welding became possible. In view of some recent developments in welding technique[1] it may be interesting to record that we later tried the effect of connecting a 60 mfd. capacitor across the secondary and found that this addition usually improved results—we assumed this was because our transformer was a little on the small side and the addition of the capacitor improved the power factor and thus the regulation.

Attracting the Volts

As the tide of war receded towards north Italy, the industries of the south gradually restarted. Some power stations which had not been demolished commenced to run again, and key transmission lines were rebuilt. Gradually a little power became available to energise street mains in the towns, but the skeleton transmission and distribution system resulted in an abnormal voltage drop.

We are now billeted in the Hotel Trento and Trieste in a street of the little seaside town of Falconara Marittima, on the Adriatic coast. The overhead street mains are at length energised at 200 V three-phase, and lights in the houses go on once more—many of these houses have been re-occupied by civilians. We decide to tap in to supply our workshop vehicles and the hotel lights at 220 V single phase, which matches our own alternator supply voltage and means that we can obtain supplies of lamps. Our alternator engine badly needs a complete overhaul; it is mounted in a lorry which is parked alongside the hotel on the pavement and underneath the street mains. There is very little civilian load in the village except for lighting, so that during the day our motors operate quite successfully. But at night the lights become very dim as the civilian load comes on. We must have better lights both on account of work which is carried on at night and for the welfare of the troops.

Our generator can be run to supply all our requirements but this is inconvenient at night and some fire risk exists then, apart from the maintenance requirement. So it is decided to attract more volts to our billets.

We have by this time acquired a small 5 kVA transformer from the local railway rectifier substation. The authorities have not worried about railway substations yet because even the steam trains are not running owing to extensive sabotage. We rewind this transformer as an autotransformer to give ratios between 220 V/220 V and 220 V/150 V. This is mounted on a switchboard in our power truck, with a change-over switch from alternator supply to street mains supply.

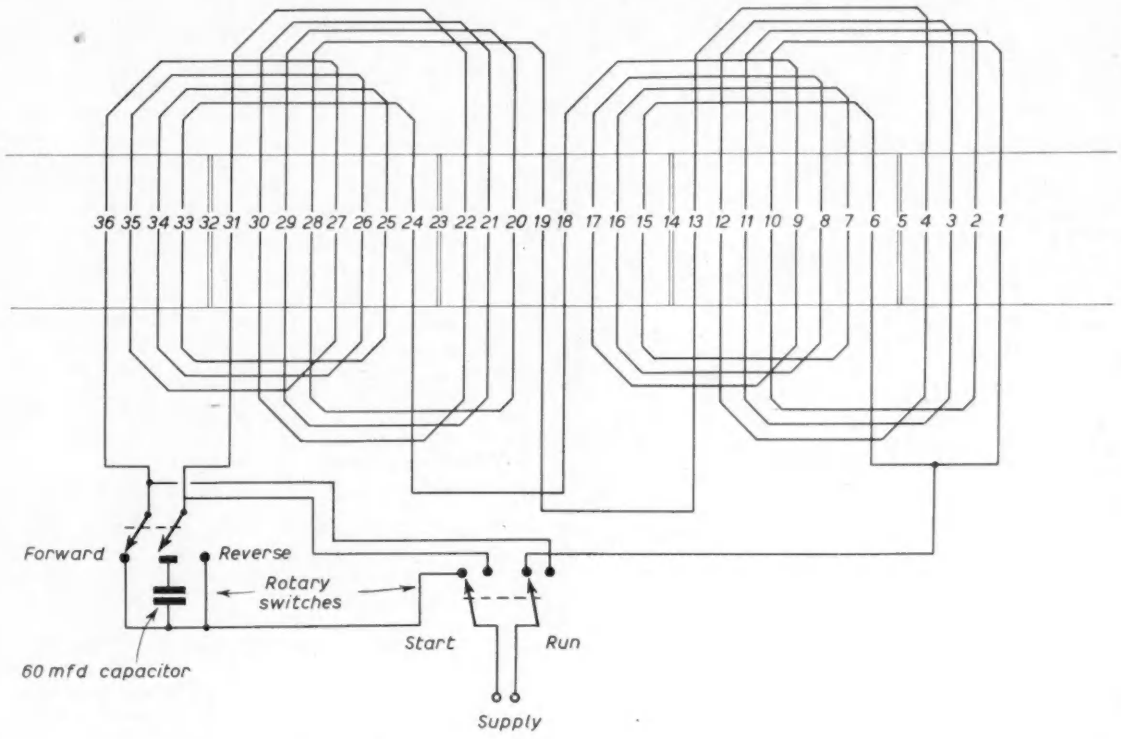
As soon as night falls the transformer is gradually tapped up, and remarkable to relate the Hotel Trento and Trieste has light of the most excellent quality. True, the lights in the rest of the street give no more than a red glow, but for many months now the inhabitants have had no electricity at all. Some time elapses before pointed remarks are heard, but by then the unit is ready to move forward once more and our generator has received a first-class overhaul.

There is no doubt that many other, even more unconventional electrical adaptations and makeshifts occurred on the field under the stress of events, and these experiences represent, therefore, only a small part of the electrical experience gained during World War II.

BIBLIOGRAPHY

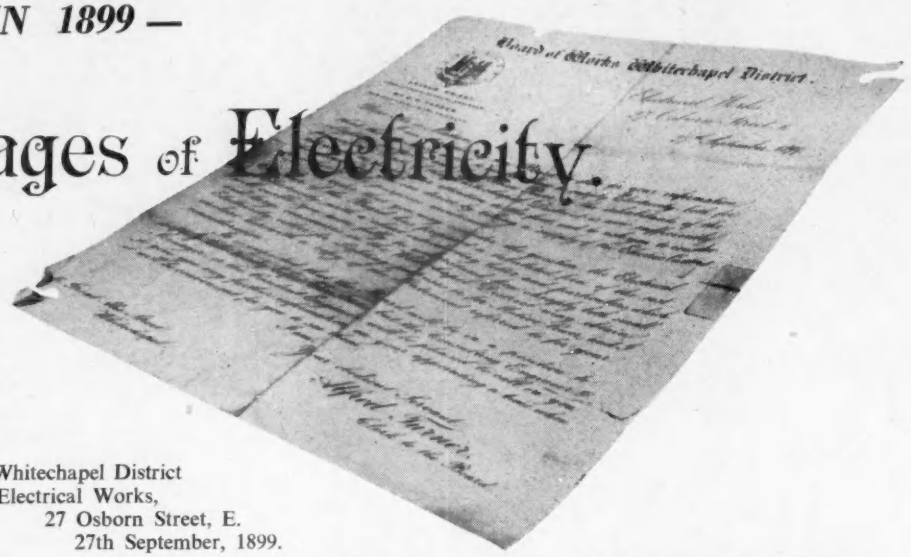
(1) "The Electric Arc and the Welding Engineer," Proc. I.E.E. Vol. 101, Pt. I, p. 21.

How to convert a three-phase, one h.p. motor, 220 V, 50 c/s to single-phase working is shown in the diagram below. The stator had originally 36 stator slots and was a six-pole machine. By using only 32 of the slots and utilising the original winding wire it was possible to develop the four-pole single-phase motor as illustrated. Note that there is no winding in slots 32, 23, 14 and 5



SELLING IN 1899 —

Advantages of Electricity.



Board of Works, Whitechapel District
Electrical Works,
27 Osborn Street, E.
27th September, 1899.

Dear Sir or Madam,

I am directed by my Board to state for your information, that the necessary work to enable them to supply Electricity both for Lighting purposes and for Motive Power, to the inhabitants of the principal Streets of the Whitechapel District is now sufficiently advanced to direct your attention to the fact, and to ask you to consider the advantages you can derive by taking a supply of Electric Current for either of the purposes mentioned.

In order that you may consider the question, the Electrical Engineer of the Board has prepared a tabulated form of the cost of Electricity, with a short introductory letter and particulars, which will enable you more fully to understand how cheaply both small and large consumers in the Whitechapel District may obtain Electricity, either for Lighting purposes or for Motive Power, and I enclose herewith a copy of the Statement referred to for your consideration.

It is expected that the Board will be in a position to supply Electricity before Christmas but the Consulting Engineer and Manager, or the Resident Engineer will be pleased to call on you to give you any further information on your appointing a time when it will be convenient for you to see them.

I am,
Your obedient Servant,
ALFRED TURNER,
Clerk to the Board.

15 *Great Alie Street,*
Whitechapel.

NOT a forceful sales letter by today's standards. But it was fitted to the needs of 1899, when the Board of Works of the Whitechapel District was preparing for adventure into the risks of electricity generation. It was the start of an enterprising campaign which resulted by 1902 in an undertaking which could claim a load-factor "superior to that of any other London concern," to quote an ELECTRICAL TIMES comment of that date.

Early in 1899 a report to the Board of Works had suggested that an electricity undertaking in Whitechapel could be made self-supporting in two or three years. The author was the redoubtable Mr Arthur Wright, of Brighton and maximum demand tariff fame. He estimated that a supply could be given to the principal streets by the autumn of 1899, using mains in asphalt under pavements to distribute d.c. on the three wire system. Amid such technical detail and financial estimates was set the spirit for the sales promotion to come: "The business must be handled in an energetic manner and not merely left to develop itself under the impression that the natural advantages of the electric light are sufficiently well known as to do away with all necessity of having actively to push the undertaking." A warning, indeed, as applicable today as at the end of the century.

The Board of Works made up its mind quickly, and by the end of January tenders were being invited for cables, arc lamps, dynamos, boilers and storage batteries. The contractors ultimately appointed included well known names today: Babcock and Wilcox (boilers), Mather and Platt (dynamos), Willans and Robinson (engines), Tudor Accumulator Syndicate (storage battery), Crompton and Co., (arc lamps), British Insulated Wire Co. ("mains laying on the solid system").

Work proceeded apace, under the direction of Mr W. C. P. Tapper who was appointed Resident Electrical Engineer in April, 1899, and on 18th December 1899, a supply was given to many private consumers. As so often happens, the official ceremony took place somewhat later, on the 21st. Then 60 arc lamps were formally switched-on. We recorded that "the permanent generating station is still in progress of completion, but in order to lose no unnecessary time to work up the business, a start was made with part of the station." A temporary structure, in fact, in one corner of the site.

Selling was still a lively exercise, and in October, before a supply was available, Mr Wright had surprised the *Meteor* of the day, who noted approvingly his proposal for a tariff of as low as 1d. per unit for motors and for heating and cooking, subject to diversity between power and lighting demands of the consumer concerned.

So matters proceeded into 1900. Load was increased and on 2nd August occurred the next event of note. The foundation stone of the new generating station was laid. For reasons of convenience the ceremony was combined with the formal opening of the District's new refuse destructor. No failure to give electricity its deserved importance, this; the refuse destructor was designed to operate in conjunction with the power station. The company adjourned to the Three Nuns Hotel, and *Meteor*, in reporting the subsequent proceedings felt it necessary to commend the oratory—only to be equalled in Hyde Park, he judged.

Certainly the councillors had a success story to boast of.

Already more than 18,000 lamps were applied for, although the present equipment exclusive of reserve was equal to only 7,350 alight together. Moreover, "The maximum demand system of charging is seen here in all its glory... Whitechapel is an ideal place for this. It abounds with small shops that keep open until nearly midnight." With lighting heavily the predominant load, long hours of use were the main hope of improving load factors. Again, *Meteor* was impressed by Mr Wright's daring. He was "so bold as to offer all current taken during the summer six months at Id. per unit, a differential tariff being restricted to the winter quarters."

The foundation ceremony was the last fling of the Whitechapel Board of Works. In November the district was merged in the new borough of Stepney, and the Stepney Borough Council Electricity Works came into being. There was continuity of personnel, however, after some references back of recommendations about salaries; and there was continuity of policy, too. For all the temporary inability to supply all would-be consumers, selling still had first place. Early in 1901 was issued the booklet "Advantages of Electricity" whose title page provides the heading for this article. A study of its pages shows how fully Mr Wright's original warning against complacency was being obeyed.

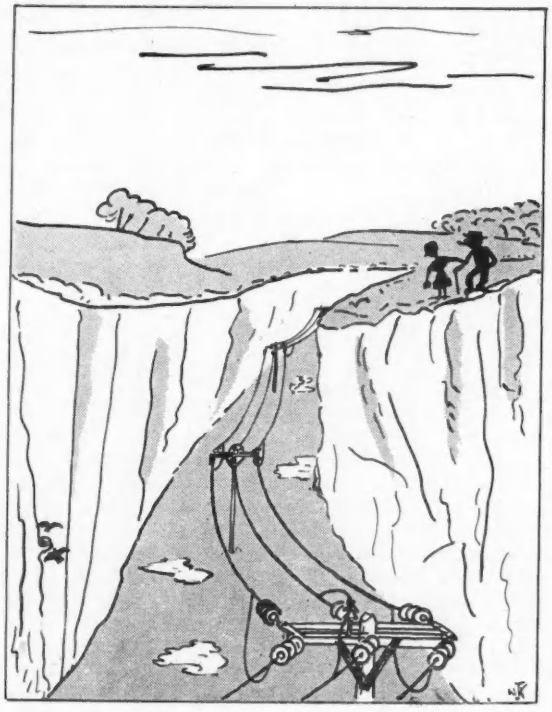
Gas was clearly an unloved competitor. The author of the booklet had this firmly in mind. Pure and Clean, his first page is headed. "The incandescent electric lamp is hermetically sealed from the atmosphere. It consumes no oxygen, gives no fumes, produces no soot, sulphur or dirt."

Gas is the target again on the next page, where under the heading "Steady and Beautiful," the reader was reminded that "there is no flickering with Incandescent Electric Lighting; no draught can affect it. Its artistic adaptability is well known." Moreover, electricity is "Convenient and Safe. Matches are not required. A simple turn of the switch and light is provided. How many hours has gas been burned to waste to save the trouble of relighting!" Convenient, Safe—and Healthy. "The danger to health from escaping gas, and the pollution of the atmosphere are done away with. One 16 candle power gas jet used more oxygen out of the air than five human beings; as previously stated, the Electric lamp uses none."

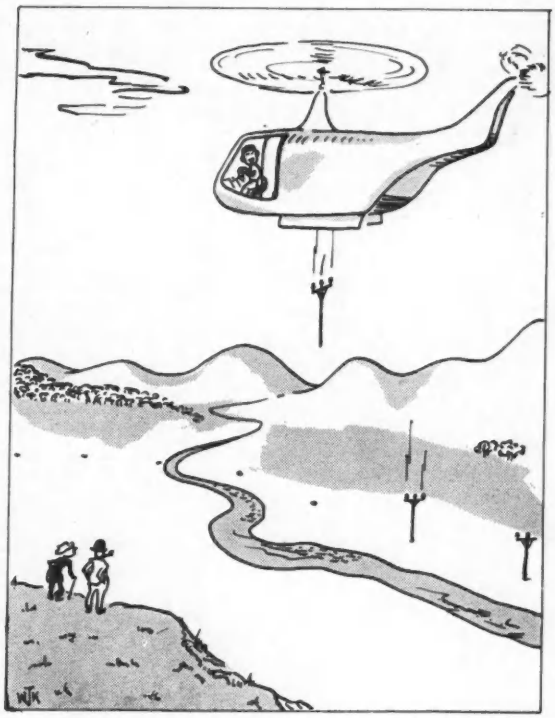
After the attractive advantages, the book comes gently to the question of cost. The average price of under three-pence per unit was a price lower than that charged by any other Undertaking in London. A curve shows how the price per unit fell from 8d. if lamps were alight for 30 hours or less a month, down to 2d. at 210 hours and 1½d. at 400 hours. What is a unit, asked the consumer of 1901. The booklet enlightened him. "A unit will light 40 lamps of 8 candle power for 1 hour, or it will light one 8 candle power lamp for 30 hours.. It will run a sewing machine for about 7 hours; it will keep two ordinary arc lamps going for about 1 hour. It is equal to about 1 horse-power used for 1 hour."

Consumers were convinced. In the financial year ending 31st March, 1902, a £2,075 profit was recorded on a £10,469 turnover. In all 1·01 million units were sold at a load factor of 22·74%. The average price was 2·73d. per unit for private supply, 1·62d. per unit for public lighting. 1,220 kW of plant was installed, and the maximum demand recorded was 506 kW. By now the undertaking was operating smoothly. Such an untoward incident as the collapse of the old engine room, which fell on to the new boiler house in April of 1902, was weathered with only a four hour outage. Service was added to economy.

It is on this tenor that this story of successful selling continues. By vesting day, the Stepney undertaking was selling 103·5 million units yearly, at a load factor of 31·98%. Installed capacity at its Limehouse station was 81·25 MW.



"I see that the confounded council at last made up its mind whether it wanted an overhead line or an underground cable"



"I suppose Robenstraw, that this is the logical conclusion of the aerial survey"

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Appointments from Outside

YOUR correspondent "J.T." has condemned the London Board for appointing their new Secretary "from the Local Authorities"; and he writes of the feeling "that the industry has been let down."

Normally I ignore anonymous letters or put them in the waste paper basket and I regard with contempt those individuals who write disgruntled letters to the electrical press, or to Journals of their Trades Unions, without having the courage to give their names. They are scarcely a credit to a virile industry.

During the past year my Board have appointed three new Chief Officials, one from within the London Board, one from B.E.A. headquarters, and one from a Local Authority which formerly had an electricity undertaking. Each appointment was made after extensive advertisement and careful interviewing; and my Board, who have a duty to the public as well as to employees are satisfied that they have made excellent selections.

Since when has there been a kind of closed shop in regard to appointments? People from inside the electricity supply industry frequently accept appointments outside that industry, and with equal frequency people from the outside have been given appointments with the Central Authority and Area Boards. This interchange of personnel is most desirable in the interest of national efficiency, and the stimulus of open competition cannot be harmful to the staff in an industry which offers great scope for men of ability. Appointments should always be made on merit, and any serious deviation from this policy would weaken the organisation concerned and lead to a justifiable condemnation from the public who are, after all, the masters of our industry.

H. J. Randall,
Chairman, LONDON ELECTRICITY BOARD.

Rural Supply

I HAVE seen from time to time the need for rural electrification being stressed by the Supply Authority and am puzzled by several instances which have come to my notice where farmers wishing to make use of electrical equipment either have difficulty in getting a supply or have to take single-phase.

In an area where there are a number of lines of various voltages, to the farmer one set of o/h lines is similar to another, and unless it is explained to him in full he is at a loss to understand the reason why the nearest lines cannot be tapped. To be told there are no mains available is insufficient information.

When a supply is available, it would again appear that the farmer is not fully informed. Supply Authorities in this area have a standard method, which consists of running two phases at 11 kV with transformers giving a single-phase, 480 V, centre-tap; (240-240). This means for motors of 10 h.p. or more they recommend 480 V supply. Other than a special order few manufacturers will supply such equipment and together with the necessary additional starting gear required for single-phase this makes it very expensive.

While the economic aspect of three-phase supply against single-phase is appreciated each system needs consideration and the farmer given the opportunity of deciding which he prefers to pay, either extra charges for a three-phase supply or the additional cost of single-phase equipment.

The main point I wish to stress is that if the policy is to encourage the farmers to use electric power, then every effort should be made to offer them a three-phase supply.

The catalogue prices of electrically driven agricultural machines are usually based on standard motors, i.e., 240 V single-phase or 415 V three-phase. Any variation from this means adding 15% to 40% to the cost, also considerable delay in delivery. Most farmers when faced with these facts make do with tractors and I.C. engines. It therefore appears that the returns from these potential power loads, which with suitable canvassing could be considerable, would in a short time more than recompense the additional cost of the extra line required to give a three-phase supply.

A. H. Smith,
DIDCOT, BERKS.

Earth Leakage Protection

I CAN understand that Mr Sansom is surprised at the omission of a reference to earth leakage tripping in the article he has read. I was aware I had left the subject in the air but I hoped to return to it before long in a survey devoted entirely to automatic protection.

I thought that a lengthy section on the subject in an article which deals with a much wider range would unbalance the theme and in the meantime perhaps Mr Sansom would kindly permit me to defer a detailed reply to his suggestions.

H. W. Swann.
WESTMINSTER, S.W.1.

Meter Reading Economics

REGARDING the article "The Case Against Outdoor Meters" in your issue dated 9th December, 1954, I am in entire agreement with the conclusion, but why read *all* meters four times a year?

The bulk of consumers fall into the Domestic Class and as it is not difficult to assess these quarterly consumptions why not read the meter once a year, assessing the interim quarterly accounts and adding to or deducting from the final annual reading as the case may require, thus appreciably reducing the annual four quarterly reading cost of 2s. 5d.

W. J. L. J.,
LEICESTER.

Checking Shaft Alignment

I WAS very interested in "A Steelworks Engineer" paper entitled Industrial Maintenance, also comments by Mr Hill in your issues of 18th November and 2nd December.

With reference to checking shaft alignment I would like to stress the following points:

(*a*) Whenever possible a reference band should be turned on both coupling periphery and face after final fitting of coupling to shaft ("manufacturers please note"). This will ensure that the coupling faces and periphery are true with the bearing journals, and rules out the complicated measurements which have to be carried out when couplings are out of true with respect to bearing journals.

(*b*) When checking shaft alignment of high speed machines such as multi-cylinder turbines, a high degree of accuracy is called for. Errors of greater magnitude than 0·001 in. should be rejected. Therefore use a clock gauge and a carefully designed holder for such an operation. Feelers, bridge gauges and wedges should be left in the tool box for less precise work.

T. A. J.
SCUNTHORPE.

Short-Circuit Forces on End-windings

DOES TESTING DO MORE DAMAGE THAN IS JUSTIFIED?

ONE of the difficulties associated with large turbo-alternators is the assessment of the behaviour of the windings under fault conditions and the problem of testing the completed machine to show that it is capable of withstanding the forces generated. As Messrs J. B. Young and D. H. Tompsett emphasised in their paper on "Short-Circuit Forces on Turbo-Alternator End-Windings," presented to the Institution of Electrical Engineers last Wednesday, the increasing size of machines makes more severe the effects of mechanical shock under fault-conditions on the machine, but, on the other hand, the distances between power stations and load centres have also grown, and this taken in conjunction with the modern practice of using directly connected generator transformers, makes the probability of faults at or near the machine terminals remote.

Faults may occur fairly frequently on that part of the system connected to the h.v. side of the generator transformer, but the fault power and current are then limited by the transformer impedance in addition to that of the alternator itself. In a typical case the peak initial current due to a h.v. fault might be reduced to half the value associated with a solid short-circuit at the machine terminals. Thus short-circuit tests from full voltage represent progressively more severe and less realistic conditions as the size of the individual machines increases. Generators of more than 100 MW are now being made in this country, and abroad generators of 250 MW at 3,600 r.p.m. are under construction. While therefore some short-circuit tests are probably desirable as a check on alternator reactances and on general manufacturing standards, it is unnecessary, in the author's views, to apply so severe a test as short-circuit from 100% rated voltage.

The End-Windings

The instantaneous force on any small element of conductor is given by $F = 0{\cdot}57\,IB \sin\theta\, ds \times 10^{-6}$ lb where I is the current through the element in amperes, B is the magnetic flux density in gauss, θ is the angle between I and B and ds the length of the element in inches. The direction of F is mutually perpendicular to the directions of I and B. If the circuits are in air, B is directly proportional to the magnetising force and therefore to the currents flowing; the mechanical forces are then functions of current products.

In a turbo-alternator with a subtransient reactance of 10%, the initial current following a 3-phase short-circuit from no-load rated voltage is ten times the full-load current. If then maximum asymmetry occurs in one phase, and decrement is neglected, a magnitude of 20 times the peak value of full-load current may be attained. The forces may consequently reach a value of 400 times the normal. While within the stator such forces are restrained by the iron, in the end-winding structure, which is in air, provision must be made to enable the conductors to withstand these displacing forces. Adequate bracing and packing is needed, and this must be arranged so that the ventilation of the machine is not impaired. For practical purposes, the end windings may be assumed to be rigidly supported at the entrance to the stator slots, and the length of overhang thus becomes an important parameter. Modern alternators with high ratings require large diameter bores with correspondingly longer overhangs than those needed on smaller machines.

Theory and Practice

It was not easy to derive an exact theoretical analysis of the forces to be expected in a practical and winding arrangement, as the magnetic fields throughout the end-winding had a complex distribution. Even if these were calculated and the forces computed, the resulting movement of the coils and the probable damage to insulation would be almost impossible to evaluate as it is difficult to ascribe quantitative values to the constraints afforded under dynamic conditions by the packing and binding. The problem is still further complicated if it is desired to make due allowance for any ageing in service of the insulating and supporting materials and to take proper account of the operating temperature of the machine.

To correlate analytical work with practical experience, investigations were carried out into the effects of a series of short-circuits under test conditions on the first of four 60 MW, 60 c/s, 13·8 kV, 3,600 r.p.m. turbo-alternators for a Canadian contract. The consultants, on behalf of the purchaser, required that the generator be subjected to a solid 3-phase short-circuit from 100% of normal voltage on open-circuit.

To check the associated test equipment two short-circuits, one at 50% and one at 75% of open-circuit voltage were carried out, and then the 100% short-circuit followed. When the final h.v. test of twice working voltage + 1 kV was performed it was found that all three phases failed. Out of 120 half-coils, 19 failed to withstand voltages to which they had been subjected prior to the test, and in 16 cases the point of failure was located just beyond the end of the core. It was found that in these cases, puncture had occurred where the wall insulation had been strained owing to movement of the conductors.

Replica Testing

From the oscillograph records of the test, the appropriate instantaneous values of current were substituted into analytically derived expressions for the circumferential forces adjacent to the knuckles of each coil and from these expressions it was possible to derive peak magnitudes in both directions over the first cycle. At the time of the tests, however, consideration had already been given to the evolution of a technique whereby the performance of any system of end-winding support could be assessed before its introduction into a production machine. The method under consideration was that the conical form of the end-winding could be developed—full scale—into a plane for the purpose of experimental work. An important question arising at that time was whether correct representation of the stator currents alone could be equivalent to the true conditions which would arise with an actual machine under short-circuit conditions. It was felt that the effect of the rotor end-caps could provide a significant distortion in the field. Further investigation

showed that as circumferential forces were predominant in causing breakdown, the rotor effect could be neglected to a large extent. The final form decided upon consisted of a double-ended replica of the end-windings under consideration. It was considered sufficient to ensure that the effect of the slot-embedded portion of the coils was adequately represented and that the distance between the two sets of end-windings was sufficiently large to obviate mutual interfering effects. Accordingly, a dummy stator with 9 in. axial length of core plates was produced entailing a knuckle to knuckle coil length of about 27 in.

Test Results

This experimental stator and windings were subjected to instantaneous 3-phase short-circuit tests, the current being supplied by a low reactance switchgear testing alternator and controlled in magnitude by the addition of external reactance in the circuit. Oscillographic records were taken of all relevant electrical quantities and devices were provided for measurement of the mechanical movement of end-windings relative to the core plates and the frame. By this means a stator winding was devised which could be practicably surveyed.

Cinematograph records were made during the short-circuit tests. Two cameras were used for this purpose, one recording at 64 frames per second viewing the whole of the end-windings, and the second recording at 1,660 frames per second, viewing the core-end-to-knuckle region of those conductors expected to experience the greatest forces in any particular tests.

It was shown that at currents equivalent to 50% full voltage elastic deflections occurred on the conductors but no permanent deformations were caused. With currents equivalent of 75% and 100% voltage the amplitude of the conductor oscillations was greatly increased and some permanent deformation of the conductors resulted.

A record was made of the distortions on the replica and a comparison with those on the original stator showed a high degree of co-relation.

In order to assess the probability of heavy short-circuits, similar in severity to those imposed by testing, the B.E.A. was requested to give details of records of such faults. Ten cases have been recorded where flashover took place on copperwork between the terminals of the generator and its associated transformer, due to causes such as vermin, water and failure of cable boxes, etc. Two cases of breakdown between phases occurred in the generator transformer on the low voltage side. One case was due to the failure of the unit transformer, and there had been a number of phase-phase failures on generator end-windings.

In conclusion, it was suggested by the authors that the time was now opportune to examine carefully all available records concerning types of fault experienced in service with a view to arriving at a more realistic winding-bracing test before dispatch. If proving tests were required they should not be carried out on the actual machine but on a short-cored but otherwise full-scale replica which would permit testing to destruction. By this means it would be possible to avoid the test damage to the machine involved in subjecting the windings to short circuit forces of a magnitude unlikely ever to be met in practice.

DISCUSSION

Mr L. W. James (B.E.A.) did not particularly agree with the authors' suggestion that there should be an alleviation in the testing of machines. As far as he was aware, no troubles had subsequently occurred on machines which had passed full-voltage short-circuit testing, but it had been known for untested machines to have their windings collapse under short-circuit conditions in operation. The expense of repair and outage on site was much greater than that which would have been necessary to put in additional bracing and blocking if signs of weakness were shown during the works short-circuit tests. The authors' comments on reduction of short-circuit currents due to generator-transformer units were only reasonable if system or busbar faults alone could be expected, but faults on machines, connections and transformers still occurred.

An opposing view came from Mr W. N. Kilner (M.V.) who did not think it was right to carry out the tests on larger machines. If damage were done in the works during testing, the margin of safety in the insulation would be reduced. He also suggested that if such tests had to be carried out the insulation should be warm which would reduce the possibility of damage. He was not in favour of model tests because one of the important features was the fitting of the blocks and bracing and a model could not test workmanship.

Mr F. C. Winfield (Merz and McLellan) referred to the end-winding as a make-up of wood, string and paper with part rigid support and part no support. It was an utterly indeterminate mechanical strucure and it was a waste of time to try to carry out a mathematical investigation. The authors' attempt at a model test was a step forward. It might be that a new design would have to be derived. Mr W. J. Carfrae (B.T.H.) thought that the margin of safety on end-windings was none too great and doubted if any manufacturer would be prepared to guarantee a machine against damage in the event of a completely out-of-phase synchronising. He felt that with present knowledge the correct procedure would be to take a three-phase short-circuit at full voltage on prototype machines but not on subsequent machines of the same type. Repeated sudden short-circuits did not do the windings any good, and some sense of proportion should be exercised in the specifications of tests to put the machine "through the hoop."

That there were some grounds for considering whether proving tests should be specified as standard or routine procedure, was a point conceded by Mr W. D. Horsley (C. A. Parsons) but he felt it was true to say the modern alternator was fully capable of standing up to a full-voltage short-circuit. In the past, many alternators had been short-circuited at full voltage, sometimes repeatedly, in order to obtain test data, and subsequent operation had demonstrated that no serious harm had been done. Nevertheless he did not think it unreasonable to make a type test on one alternator and to apply a 50% or perhaps a 75% voltage test on other units, if only for the purpose of checking the reactance.

The onus was put on engineers by Mr J. W. Laing (G.E.C.) who said it should be possible to fix the windings so that they were either stopped from moving or to design in such a manner as to allow a more rational freedom of movement.

Type testing was also approved by Mr J. F. Dunn (Kennedy and Donkin). There were, he thought, two methods of type testing. One was to adopt a model test arrangement as was suggested in the paper, and the other was to put sample windings on a machine which was going into service and strip them down after test.

Design features were attacked by Mr M. Walters (E.R.A.) who said that the normal design condition allowed the copper to stress well beyond its elastic limit and also bruised the insulation under short-circuit tests. One of the things to aim at was to find a supporting method which would hold the windings in such a manner that the stresses in copper and insulation would become amenable to calculation.

Present developments in materials were the subject commented on by Mr N. G. McCullagh (Permali Ltd.) when he suggested that there were new substances available which could lead to considerable improvements in the structures supporting the end-windings. These materials would, he felt, be of great value in providing reliable end-winding supports of sufficient strength for the new larger machines.

Finally, Prof M. G. Say (Heriot-Watt College) wondered whether an entirely new approach to end-winding design was not overdue. Would a designer, without fifty years of works experience behind him, attack the problem on the existing lines. He doubted it!

The authors replied briefly.

CONTROL OF DISTRIBUTION SYSTEMS

Midlands Electricity Board Opens New Centre at Ocker Hill

A NEW distribution centre just completed by the S. Staffs and N. Worcs. Sub-Area of the Midlands Electricity Board is situated on land adjoining the Generating Station at Ocker Hill, where a decision has recently been made to install two additional 30 MW generators. The extension of the station building required to house the extra generators and boilers entailed the demolition of the switch-houses and control room owned and operated by the Area Board, and the opportunity so arising was used to re-arrange the equipment through which the Area Board, at this point, takes its supply. Power from the generator 33 kV busbars is conveyed through four 60 MVA group-feeders to the Area Board's 33 kV busbars, each group-feeder consisting of nine 0·5 sq in. single-core cables, three per phase. These cables are housed in an underground cable tunnel newly constructed for the purpose.

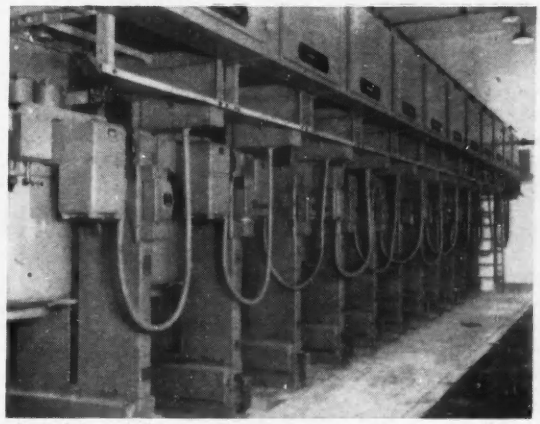
The fault energy on the Area Board's switchgear is controlled by B.T.H. cast-in-concrete reactors in each group-feeder, previously existing reactors being used. All the reactor banks required modification; two sets by the addition of coils to increase the overall impedance, and two sets by the addition of forced cooling equipment to increase the output.

The main 33 kV switchboard consists of 23 units of Ferguson Pailin manufacture, type VSRP 32. It has duplicate 1,200 amp busbars and is covered by a scheme of bus zone protection. From the switchboard feeder cables radiate to various points in the Sub-Area; other feeders supply three banks of station transformers, and still others feed a bank of four Scott-connected transformers (three of 15 MVA capacity and one of 12 MVA capacity). The Scott-connected transformers in turn supply a 7 kV 2-phase duplicate busbar switchboard, again of Ferguson Pailin manufacture, type FVD, consisting of 29 units. The main switchgear is housed in four separate and fire-proof switch-houses.

The control board, in which is incorporated the control of the reactor cooling equipment and indications and alarms for the fire fighting apparatus, is in the form of a horse-shoe, and housed in a room 32 ft by 54 ft. Relays, bus zone, A.V.C. and tariff metering are all mounted on separate panels.

An extensive scheme of fire protection has been carried out. This, in the cable tunnel, takes the form of a Mulsifyre sprinkler system which covers not only the cable tunnel but cables in the cable trenches in the switch-houses. The switchgear itself is covered by a fixed CO_2 installation, supplied by W. Kidde and Co., and operated by rate-of-rise detectors with over-riding manual control to external positions adjoining the door of each switch-house.

Heating of the buildings is provided by a 200 kW electrode boiler, manufactured by G.W.B. Electric Furnaces



Part of the main Ferguson Pailin switchgear at the centre. At the top of the page the illustration of the control room shows the simplicity of layout and arrangement

Ltd., with which is associated a 6,000 gallon thermal storage tank. Floor heating is embodied in the control room. All pilot and telephone cables are marshalled in a separate room which will be used for future equipment.

In addition to controlling the local supply of energy the operational control of the whole of the Board's system in this Sub-Area is centralised at this point. For this reason a V.H.F. radio communication system in use in this Sub-Area is operated from this same control room.

The whole of the building, civil engineering work, laying and jointing of cables has been carried out by the Sub-Area staff. The whole of the work, which was decided upon in 1951, was carried out according to a very tight programme which has been successfully adhered to throughout, and within the original estimated cost.

On Wednesday, 8th December, an official visit was paid by the Chairman of the Board, Mayors and Officials of Local Corporations, Members of the Consultative Committee and Members of the Area Board Headquarters' and Sub-Area Headquarters' Staffs to the new Centre.

SPOT WELDING SMALL COMPONENTS

Precision operation for mass production work

THE problem of joining very thin non-ferrous wires or strip is one which frequently occurs in the mass production of small components.

To perform this difficult task using as far as possible unskilled labour, the General Electric Co. has produced a precision 4 kVA spot welder which can easily be set up to perform welds generally considered difficult or impossible.

The capability of the machine—as far as materials are concerned—is shown by the table which is, however, only intended to act as a general guide, since the design of the workpieces themselves naturally have a considerable bearing on the possibility of successful welding. For example, whereas brass is easily welded in sheet form, it is difficult to use the same material for cross-wire welding.

To provide a specific case in which the spot welder can be used to its best advantage, the manufacture of Trico thermally operated flasher switches may be quoted. Here dissimilar non-ferrous metals have to be joined in wire to sheet form to make reliable electrical contacts. The wire is 32 s.w.g. copper nickel and is welded at one end to beryllium copper strip 0·006 in. thick, and at the other end to mild steel of substantial section.

The accuracy of control of the machine is such that the two welds can be accomplished using the same mean settings, no time being lost between welds in altering the controls. The short welding time of about one-fiftieth of a second is sufficient to eliminate the water cooling of the electrodes.

Essential features of the welder are continuously variable controls for current and pressure, each fitted with graduated scales, and electronic control of welding times between one and six cycles (0·02 and 0·12 seconds). To ensure that the exact performance of the machine, once set up, will be repeated the welds are synchronised to start always at the same point in a supply cycle.

The top electrode is carried in a special low inertia electrode holder to give the quick follow up necessitated by the rapid collapse of the metal being welded. Initiation of each welding process is by a foot operated switch, which is arranged to function only when the present pressure has been applied. To facilitate the use of jig assemblies an accurately machined and slotted base plate is provided, and the welding head can be adjusted in height and moved radially about its shaft. A built-in lamp illuminates the work and a signal lamp gives visual indication of a completed weld.

Close-up of welding head of the G.E.C. precision spot welder which is seen in great detail with the operator joining dissimilar non-ferrous metals in wire to sheet form in the production of Trico thermally operated flasher switches. Below is a table showing metals which in sheet or wire form can be welded

WELDABILITY CHART

	ALUMINIUM	BERYLLIUM COPPER	BRASS	COPPER	COPPER NICKEL	GOLD	INCONEL	MILD STEEL	MOLYBDENUM	NICHROME	NICKEL	NICKEL IRON	NIMONIC	PHOSPHOR BRONZE	SILVER	STAINLESS STEEL	TANTALUM	TUNGSTEN
ALUMINIUM	x														x			
BERYLLIUM COPPER		x	x		x					x	x			x				
BRASS		x	x	x				x			x			x	x			
COPPER			x	x	x	x		x		x	x			x	x			
COPPER NICKEL		x		x	x		x	x	x	x	x	x	x		x	x		x
GOLD	•			x		x									x			
INCONEL			x				x	x	x	x	x	x	x			x		x
MILD STEEL			x	x	x		x	x		x	x	x	x	x		x		x
MOLYBDENUM					x		x				x	x	x				x	x
NICHROME		x		x	x		x	x			x	x	x	x		x		
NICKEL		x	x	x	x		x	x	x	x	x	x	x		x	x	x	x
NICKEL IRON					x		x	x	x	x	x	x	x			x		x
NIMONIC					x		x	x	x	x	x	x	x			x		x
PHOSPHOR BRONZE		x	x	x				x						x	x	x		
SILVER	x		x	x	x	x					x			x	x			
STAINLESS STEEL					x		x	x		x	x	x	x	x		x		
TANTALUM									x		x							x
TUNGSTEN					x		x	x	x		x	x	x				x	x

From an engineer's notebook

SCIENTIFIC research is not unlike a series of detective stories, particularly since each successive denouement usually leaves as many loose ends untied as the author of the average "whodunit." Certainly a recent investigation by the Bell laboratories has for me all the marks of a Scotland yard enquiry. The trouble started with a breakdown of a capacitor in a filter network and the cause lay in a number of lint like particles lodged on the surface of a supporting bracket. Simple cleaning restored the capacitor to operation, but what were the particles and whence had they come? The first line of investigation lay in considering them as a corrosion product. Then followed months of patient work in an endeavour to reproduce the effect under laboratory conditions, a reconstruction of the crime as it were. As the original bracket had been zinc coated, suitably coated steel specimens were subjected to high humidity in the presence of organic materials, the conditions in which the effect had first been observed. At last the growths commenced to take place. They were filamental in character, each thread being some 80 millionths of an inch thick and up to one sixteenth long. Spectroscope study confirmed that they were metallic zinc and X-ray diffraction showed them to consist of single crystals of the metal. Then followed the elimination of the suspects. It was shown that neither humidity nor the presence of organic matter had any influence on growth. Unexpectedly perhaps, tests in vacua showed no change but at pressure over 2,000 lb/sq in. the growth took place in a few seconds. Temperature had only a limited effect, the optimum value being 125° F. What is more significant however, is that other metal platings showed similar effects. Here, I must leave the story for although much has been discovered, the final denouement must await the next chapter of research.

* * *

SEVERAL months ago I wrote of the segregation of impurities that takes place on cooling a molten metal and of how this action which is sometimes responsible for the eventual cracking of steel pressings, had been utilised for the purification of germanium. This zone fusion process as it is now called, involves the heating of one section of a bar to fusion point and traversing the zone from one end to the other. As the pure element tends to solidify first, the impurities thus migrate to the end. I am interested to see that this technique has now been applied to aluminium and by the use of as many as nine fusion processes, metal of conventional purity has been refined to about 99·9995% purity. It might almost be said that the method opens up a whole new field of investigation into super-purity metals. In the case of aluminium it has been found that the few additional ten-thousandths of one % in purity have pronounced effects in the metal characteristics. The full extent of these has not yet been studied, but a start has been made on resistance and it has been found in the temperature range up to about 10° absolute, the temperature co-efficient can vary up to six to one compared with commercial aluminium of 99·99% purity.

* * *

SMOG is in the air. We are still not out of the annual fog belt and now Sir Hugh Beaver's committee has offered us some seasonable tidings in their report on the prevention of air pollution. As the future of these recommendations seems to be as obscure as smog itself, I only venture to mention this thorny subject in order to point out that there appears to be one form of air pollution that was not even considered by the committee, that is the presence of radio-activity. Long before America and Russia started playing with brighter and better atom bombs, the existence of radon in the air had been established with the suggestion that it came from the soil. More recent work has clearly shown, however, that the radon content definitely increases under fog conditions and indeed there is good co-relation between radio-activity and solid matter in the air. While this increase may in part be due to conditions which prevent the dispersal of the radon content, there is now strong evidence to show that the source of this radon is the burning of coal and coal gas. Laboratory experiments on the combustion of coal show that 70 to 80% of the equilibrium radon in coal is liberated into the atmosphere on normal burning. Further, coal gas likewise contributes to atmospheric radon content. Much work remains to be done before a proper assessment can be made but concentrations can apparently range up to 40×10^{-11} curie per litre which is an estimated figure for the 1952 smog. What the effect will be of such a dosage on health is at present being investigated. One thing is certain, whatever the conclusion, public clamour will wax loud on this form of pollution as soon as atomic power stations are on the bars.

* * *

I HAVE always believed that gas pokers and bunsen burners were the two appliances in which the gas industry were ahead of electricity. It is quite a time since I first saw an electric "gas poker" and although I never used one I always felt that a flame was the right idea to ignite fuel, particularly the recalcitrant kind we have today. Recently I came across an electric bunsen burner. This is constructed of a heating element surrounded with an anodised aluminium reflector which projects the radiation through an orifice at the top. As a means of heating it should be excellent and it has the additional advantage that it can be used in any position, upside down if necessary. A separate regulator provides full heat control but adds still further to the high cost of the unit. Unquestionably the safety and convenience of this device will find a use but I am glad that in my lab days we had the gas bunsen with all the fun with a blow pipe and charcoal and the exciting colours with a platinum wire. *E. R. G.*

High Voltage Measurements

Trio of I.E.E. Measurements Section papers discuss High Stability Supplies and Absolute Measurement

ALTHOUGH only one of the three papers presented last week to the I.E.E. Measurements Section was concerned with the direct measurement and indication of high voltage, the other two, discussing the stabilisation of high voltages, were equally associated with their measurement, since any method of stabilisation involves measuring the h.v. output for its comparison with a reference source. The stabilised high voltage—50 kV, d.c.—was required to power an electron microscope in an experimental attempt to achieve a resolving power of atomic dimensions. To this end the supply was required to be stable down to a few parts in 10^6 over intervals of up to ten minutes.

Several methods are available for stabilising such voltages, the most common being that employing degenerative feed-back. In this system a transformer-rectifier equipment supplies the load, whilst a resistance potential-divider supplies a measure of the high voltage, the tapped voltage being compared with a reference voltage—usually a battery. Any fluctuations present in the output then show themselves as a difference voltage when compared with the reference, which is amplified and applied to the high voltage in a sense necessary to correct the original fluctuations. However, this method provides stability up to only 1 part in 10^6 and serious practical difficulties present themselves when attempting to increase the stability. Other methods must then be considered, and that chosen by the authors—M. E. Haine, M.SC., F.INST.P., and M. W. Jervis, M.SC.(TECH.), A.M.I.E.E.—employed an electron-optical system.

By this method of stabilisation, the output voltage is made to accelerate a beam of electrons. Their velocity is then measured by deflecting them in a fixed magnetic field, and hence obtaining an input signal for the feed-back amplifier. Of the available methods of measuring, or analysing electron velocity, this method, which involves deflecting the beam through 180°, gives rise to electron-optical aberrations but, for other reasons, was considered most suitable for the purpose required.

Principle of Operation

In principle, the beam, on being directed into a uniform magnetic field, in a direction perpendicular to the field, is deflected in the arc of a circle and if the field is limited at a boundary through which the beam enters, the beam emerges from the field in an opposite direction. Any variation of the voltage employed to accelerate the electrons thus alters their incident velocity, effecting a corresponding variation in the point of emergence which can be made to provide a suitable signal for amplification and feed-back.

In the equipment described, the high voltage output was desired to be stable to 2 parts in 10^6, which meant that changes in the beam output position to be detected were of the order of 1 part in 10^6 of the radius of the electron path. To produce this accuracy, the beam from the electron gun had to be clearly defined, effected in this case by allowing it to fall on to an earthed defining edge which cuts off most of the beam and allows only a fraction to pass into the field. To overcome further difficulties due to the far edge of the beam thus being left undefined and also having a low electron density, a second defining edge was placed at the point of emergence of the beam from the field to produce a narrow "slit" of electrons, of high current density, and having sharply defined edges. The output beam passes into a collector signal to produce a negative signal for the feed-back amplifier. Any change in the accelerating voltage, under these conditions alters the beam density, and hence the magnitude of the signal.

In practice, the analyser was constructed to be operated with either a permanent or electro magnet to provide the deflecting field. The defining edges were machined in a single brass bar, with copper inserts mounted in the ends, the actual edges being lapped straight to microscopic tolerance. Test results showed that for one hour an effective stability at the analyser output of 1 part in 10^7 could be obtained, although ripple voltage, initially, proved to be excessive. The tests were made by measuring the variation in output from a second stabiliser operated in parallel with that being used for stabilising. Long term drift, however, was as high as 10 V/min but, on subsequent modification, this was reduced to two to three parts in 10^6 with some day-to-day variation.

An essential requirement of the stabiliser, however, is that the magnetic field strength remains stable and where an electro magnet is employed, this requires a stable current source. For this purpose, a degenerative feed-back system was developed, and described in a second paper by M. W. Jervis. The stabiliser was required to deliver a maximum current of 150 MA with a stability of 4 parts in 6^6 and employing mercury primary cells, with copper wire terminal cells, as a source of reference voltage, this was obtained.

Attracted Disc Voltmeter

The remaining paper in the trio, presented by G. W. Bowdler, M.SC., gave details of the design and performance of an attracted disc voltmeter, operating in a medium of compressed gas, and capable of measuring the effective value of a wide range of voltage. The accuracy of measurement increases with voltage magnitude, ranging from some 1% at 1 kV to 0·1% at 30 kV and above, and whilst the moving electrons have been designed to withstand voltages up to 700 kV (peak), measurements have been limited to half that value by the insulator supporting the h.v. electrode.

Basically the instrument comprises a pair of parallel plate electrodes suspended in a pressure vessel. The electrode construction is based on that devised by Kelvin, in which the central portion of one of the electrodes comprises a disc separated from the remainder by a narrow annular gap. Measurement is effected by determining the attractive force acting on the disc, whilst provision is also made for detecting displacement of the disc from the plane of the surrounding guard plate and for varying and measuring the distance between the electrodes. The revolving disc and guard plate are made the earthed electrode, whilst the pressure vessel is also earthed. The disc diameter itself was, nominally, 10 cm with that of the h.v. electrode and guard ring 40 cm and 56 cm respectively. In operation it is filled with either nitrogen at a pressure of 150 lb/sq in. or a mixture of nitrogen and "Arcton 6" at a pressure of 50 lb/sq in., both atmospheres giving the same accuracy.

POWER SUPPLY Statistics

NOVEMBER

As in October, one of the main features of the new plant commissioned by the B.E.A. last month was the presence of diesel plant, to be employed primarily to augment steam plant at peak load periods. Apart from diesel generating sets, however, there was still an impressive total of steam plant commissioned, aggregating 180 MW of generating and 665 klb/hr of steam raising capacity, and comprising four turbo-alternators and two boilers.

Of the steam stations concerned, Drakelow A (East Midlands Division) sees its first item of plant—a 515 klb/hr boiler. This is an International Combustion unit, supplying steam at 1,500 lb/sq in., 1,050° F at the t.s.v. and will power 60 MW, English Electric turbo-alternators. The lion's share of November's new plant, however, goes to the North West, Merseyside, and North Wales Division, in which four stations' generating capacity has been augmented. Of the two 30 MW turbo-alternators commissioned, one is recorded at Bold A (the second for this station) and the other at Roosecote (the third). Both are Metropolitan-Vickers machines, whilst the boilers at each station are 300 klb/hr Yarrow units. Ince generating station records its first 60 MW turbo-alternator, a General Electric Co. machine, the boiler for which, commissioned in August, has a 550 klb/hr rating, and is of International Combustion manufacture. Finally, for the Division comes Blackburn station, whose steam raising capacity increases by 150 klb/hr by the commissioning of a further Simon-Carves boiler. Concluding the steam stations is Portobello (South East Scotland) where, as foreshadowed in the previous report, a 60 MW Richardsons, Westgarth turbo-alternator now partners the 540 klb/hr boiler commissioned in October.

Turning now to the diesel plant, first on the list comes Ashford (Kent) station, South Eastern Division, which has a second 2 MW, Mirrlees, Bickerton and Day generating set accompanying that commissioned in October. For the South Wales Division is a 1·22 MW set at Haverfordwest, this being of Crossley manufacture, whilst in the Eastern Division, Clacton records a 0·95 MW English Electric unit.

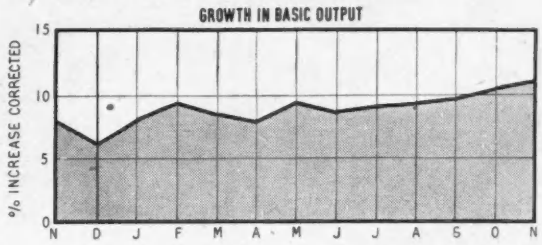
B.E.A. Sales to Area Boards in November

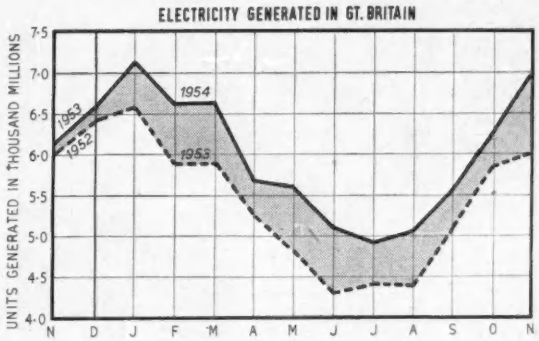
Board	November sales in million units	% inc. on November 1953
London	591·1	10·5
South Eastern	338·5	10·7
Southern	417·8	15·1
South Western	215·5	22·2
Eastern	566·3	12·7
East Midlands	498·4	18·1
Midlands	660·2	13·8
South Wales	366·0	14·3
Merseyside and North Wales ...	374·6	18·2
Yorkshire	637·1	14·0
North Eastern	367·2	9·4
North Western	702·9	12·7
South East Scotland	141·6	15·1
South West Scotland	338·7	13·8
Direct Sales by B.E.A.	135·2	62·7
Grand Total	6,351·1	14·5

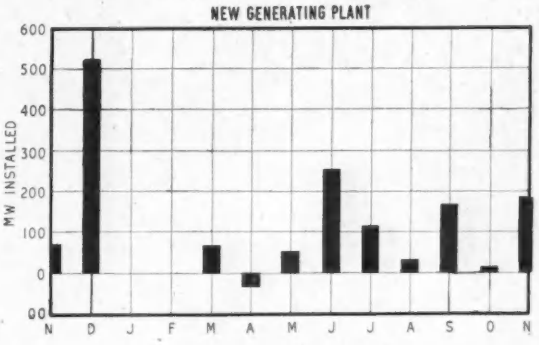
As with steam plant, it is again the North West, Merseyside and North Wales Division which records the lion's share, with three 1·28 MW sets, by Harland and Wolffe, all commissioned at Blackpool to bring the total there to four.

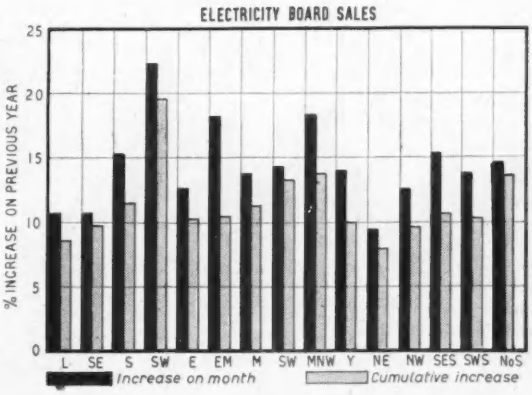
With an increase of 188 MW in its generating capacity, the B.E.A. total now stands at only 571 MW short of 20,000 MW of installed capacity. With the end of the year rush to commission plant which December brings, it seems likely that this milestone will be reached before 1955.

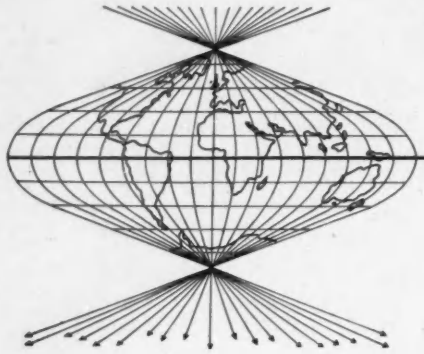
The North of Scotland Hydro-Electric Board, however, recorded a fall in installed capacity, which now stands at 586 MW, 5 MW less than the previous month.











OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Work in New Brunswick

Construction on the extension of the Chatham steam power plant of the New Brunswick Electric Power Commission is expected to begin next spring. The extension, to house a 29,500 h.p. turbo-alternator, is scheduled to be finished by late 1956. The N.B.E.P.C. is faced with the prospect of increased demand for power from the mining industry, principally in the north shore area, before the Beechwood hydro plant is completed in late 1957. The Chatham expansion programme will be completed a year before Beechwood and it is hoped it will fill the gap. A single steam turbine now generates 15,000 h.p., and the 69,000 kW transmission line fed from Chatham is connected with the province's grid system. At Beechwood two 45,000 h.p. units will be installed, with provision for another unit of similar capacity when demand warrants.

Supply in Bulk

A five-year agreement has just been signed, providing for the supply of electric power to the Potash Co. of America by the Saskatchewan Power Corporation. The Potash Co. is at present undertaking drilling operations east of Saskatoon. In the initial stages, the company expects to utilise about 32 million units per annum, but in the event of mining operations proving very successful, it is estimated that the annual consumption of power at the plant will be around 60 million units per annum by 1958. Such extensive expansion will probably necessitate the installation of further generating plant by the Power Commission in addition to the 20 MW set put into operation at the Estevan station just over a year ago.

Money for Rural Work

The Quebec Government's measure to provide an additional $5 millions to the existing $25 millions which has been set aside for rural electrifieation, was the subject of some criticism in the Legislative Assembly earlier this month. Some members, while not opposed to voting the money for rural electrification, wanted details of how the money had been spent so far. But Premier Duplessis pointed out that during the ten years of the present administration the number of farms that had been electrified had risen from 20% to 86%. At the end of 1953 a total of 17,119 miles of new electric power lines had been erected to supply rural areas. The Premier earlier told the House that Quebec was one of the richest provinces in the Dominion in so far as hydro-electric power supplies were concerned. "But in spite of the fact that we had ample power sites at our disposal," the Premier declared, "the power companies were not interested in supplying power to outlying districts because they claimed they could not do so at a profit. They were only interested in building power lines close to the source of supply. The present government overcame this difficulty by setting up co-operatives and these co-operatives proved highly successful," he added.

EUROPE

Extension Approved

The Spanish Ministry of Industry has authorised the Compania Sevillana de Electricidad of Seville to extend its hydro-electric power station on the Guadalevin River at Tajo de Ronda. In this extension, two 1,500 kVA three-phase alternators are to be installed, one of which will be direct-coupled to a 2,000 h.p. water turbine, and the other to two 1,000 h.p. turbines. Two 1,500 kVA transformers, protection equipment and switch and control gear will also be required.

Italy's New Station

A new thermal electric power station, capable of producing up to 260 million kWh per annum, has been inaugurated at Chivasso, in Piedmont. Built for the S.I.P. (Societa Idroelettrica Piemontese), the new plant was included in the 1948 building programme for the development of Italy's power resources. The programme, which has now been completed, had increased the country's thermal-electric potential to 2,398,000 kW by the end of 1953, compared with 1,200,000 kW in 1948. Over the same period, hydro-electric potential increased from 6,307,000 to 8,874,000 kW.

ZANZIBAR

A Modern Supply

Bringing the first a.c. electric power supply to the island of Zanzibar for industrial and domestic use, the new Saateni power station has been officially opened by the Sultan of Zanzibar, H.H. Seyyid Sir Klalifa bin Harub, G.C.M.G., C.B.E. The station is sited 1¼ miles from the ancient Arab quarter of Stone Town. It will provide power for the oil mills, and other industries which are already moving to the Saateni area, where further development is planned. The equipment for the power station has been manufactured by the English Electric Co., Ltd., to the order of the Crown Agents for Overseas Governments and Administrations. The consulting engineers were Preece, Cardew and Rider. Installed are three 1,088 b.h.p. 375 r.p.m. diesel alternator sets, generating at 11kV, 3 ph. 50 cycles. The equipment is complete with station accessories, h.t. switchgear, l.t. distribution boards and ten substations for the 11 kV ring main round the city. The English Electric Co. were responsible for the installation of all the equipment, including o.h. and underground distribution mains. There is already a d.c. power supply for the island, provided by the Stone Town station where E.E. equipment is also installed, some of it over 30 years old. For the dock and harbour works, a d.c. supply will continue to be available via two rectified units.

INDIA

Bulk is Cheaper

A scheme is to be put in hand to interconnect the Nangal-Bhakra power system of the Punjab Government with the system of the Delhi State Electricity Board, chiefly in order to import power into Delhi, but it will also enable the latter to export any surplus supply if necessary. Initially, it is expected that the Delhi State Electricity Board will take 10,000 kW from the Punjab grid, but that figure will quickly be raised to 20,000 kW, and later increased to 40,000 kW and possibly more. The scheme involves the erection of a main substation and five distribution substations, together with a 33 kV double circuit transmission line. This scheme was originally prepared at the end of 1948 when the Delhi Central Electric Power Authority Ltd. was considering installing additional plant at its "B" power station. It is pointed out that the estimated cost of the grid scheme is about

Rs.78 lakhs for an ultimate capacity of 75,000 kVA or Rs.104 per kVA installed inclusive of transmission system. The present day cost of steam generating stations is put at Rs.1,100 per kVA installed plus transmission equipment. It is further added that in view of the revenue that will be earned from the expenditure of Rs.78 lakhs on the new grid, an increase in tariffs to consumers is unlikely.

BORNEO

Revised Brunei Scheme

A plan to give Brunei a State wide electricity grid network, fed from a new power station which would utilise waste gas from Seria oilfield, which was reported last April, has now been shelved by the Development Committee charged with administering Brunei's Five-Year Development Plan. The reason given is that the village and jungle folk in Brunei are not yet ready, in the opinion of the Committee, to utilise the electricity service to the full. Instead of the power station and the transmission line network, the Development Committee has put forward a considerably modified scheme. Under this, it is suggested that generating capacity at Brunei Town and Kuala Belait, at opposite ends of the State, should be increased by about 600 kW each before the end of 1955; that small new generating stations be established at Tutong and Temburong, and that a big publicity campaign should be started to tell the population of the benefits of electricity. The Committee adds that the original electrification plan will be revived when there is an indication that the Brunei kampong and jungle folk are becoming electricity conscious.

AUSTRALIA

Victoria's Good Year

A record profit of £359,000 was earned by the State Electricity Commission of Victoria during its year ended 30 June last, it is shown in the Commission's annual report just tabled in Parliament. The main points of the report are an increase of 16% in sales of electricity; an additional 33,000 consumers connected a record addition of 136,000 kW to the generating capacity, and a record output of 8 million tons of brown coal at Yallourn and Yallourn North. All departments made a surplus except the provincial tramway systems in Geelong, Ballarat and Bendigo. But warning is given that despite new plant, the Commission has not been able to build up a reserve of generating capacity to safeguard against unexpected breakdowns or national and other emergencies. Furthermore, it would probably take 10 years before the reserve had been built up after allowing for the probable increase in consumer demand. A total of 581,000 homes in Victoria now received electricity from the Commission.

Borrowing Powers

A Bill to increase the borrowing powers of the State Electricity Commission of Victoria by £50 millions to a maximum of £215·5 millions, has been approved by the State Legislative Assembly. The extra borrowing power was needed to provide for continuing extensive electricity undertakings throughout the State, Mr Cain, the Premier, declared, adding that in ten years Victoria would be an all-electric State. One member suggested that the Commission would function more efficiently if some of its activities, particularly the manufacture of briquettes, were split up.

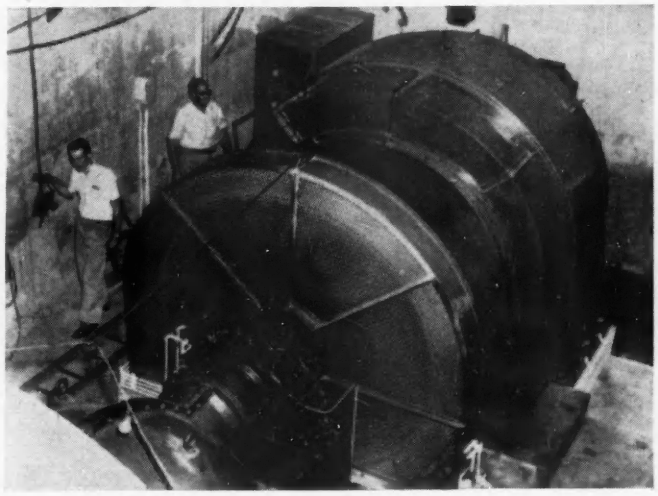
Another Amalgamation?

Following the merger of the Toowoomba Electric Light and Power Co., with the Southern Electric Authority, the State Electricity Commission of Queensland considers the next important step which requires early attention is the complete unification of the supply system of south-eastern Queensland, it is stated in the Commission's annual report just published. This obviously infers unification of the Brisbane City Council's undertaking and that of the Southern Electric Authority. Mr Neil Smith, the Commissioner, points out that the supply systems in south-eastern Queensland are already interconnected, but have been developed generally as separate systems based on separate sources of generation. He also states that fears of electricity supply shortages have been removed in practically all parts of Queensland for the first time since the war. In a general review of activities for the year, the report states that there are ample quantities of power available in the Wide Bay-Burnett, Capricornia, and Townsville Regional Board's areas. Planned plant installation should keep them ahead of all future demands. Following Southern Electric Authority's commissioning of 60,000 kW of plant in the new power station at Bulimba, the inter-connected system of South-east Queensland is now reasonably secure.

NEW ZEALAND

Geothermal Power

The indications were that sufficient steam was already provided for the initial heavy water plant and associated 40,000 kW electric-power generating plant for Wairakei, said Dr H. R. C. Pratt, a member of the United Kingdom Atomic Energy Authority and leader of the visiting British designing team when studying the site at Wairakei recently. Detailed design of the projects would start almost immediately, and both would probably come into production about the same time, 1958. Problems which had arisen, among them corrosion, were not insurmountable, he added. The heavy water process has been made possible by the development of a new type of distillation column evolved at Harwell, in which a New Zealander, Mr J. A. McWilliams, of the Department of Scientific and Industrial Research, played the major part. Dr Pratt expressed satisfaction at the work on steam purification and corrosion carried out by the department's officers at Wairakei, and said that drillers and engineers had done "a grand job."



Intended primarily to provide water for Brisbane (80 miles away) and to mitigate floods in the Brisbane River valley, the Somerset Dam built by the Stanley River Works Board, Queensland, Australia, has a storage capacity of 724,000 acre-feet. It was also decided to utilise the water released to generate electricity, and the dam was provided with a 9 ft dia. steel-lined tunnel leading to a power station housing a 3,200 kW 375 r.p.m. water turbine generating set supplied by Boving and Co. A double-runner turbine of the Francis type is coupled to a 4,000 kVA 0·8 p.f. waterwheel generator, which with the switch and control gear was supplied by Metropolitan-Vickers Electrical Co., Ltd. This 4,000 kVA set is shown alongside. The generator is a standard horizontal machine with closed air-circuit ventilation. The set can be controlled either locally or from a substation above the flood level 120 yards away. Remote control is semi-automatic: on operating the "start" switch the machine starts and runs up to speed, synchronising adjustments being carried out and the oil circuit-breaker being closed by operating the appropriate control switch. Local control can also be semi-automatic if required. The power generated is fed into an adjacent substation

Personalities

IN THE INDUSTRY

Works manager to Allen West and Co., Ltd., since 1935, **Mr G. Stanning,** M.B.E., retired last week, after more than 40 years service with the company.

Mr V. Watlington and **Mr T. W. Heather** have been re-elected for the tenth year in succession to act in their respective capacities of chairman and vice-chairman of the Electrical Fair Trading Council. Two changes in membership representation on the Council have recently occurred. For the Associated Manufacturers of Domestic Electric appliances, **Mr C. R. Duncombe** is now the representative in place of **Mr Raymond Baxter,** while for the Electric Discharge Lamp Auxiliaries Council, **Mr F. Norris** takes the place of Mr W. C. Huston.

The Minister of Fuel and Power has appointed **Sir Charles Bartlett** as a part-time member of the Eastern Electricity Board as from 1 Jan. 1955, and **Alderman P. W. Barnes** in a similar capacity with the Southern Electricity Board.

Sir Ewart Smith, technical director of Imperial Chemical Industries Ltd., succeeded **Mr Tom Williamson,** general secretary of the National Union of General and Municipal Workers, as chairman of the British Productivity Council at its annual meeting last week.

Three new appointments are announced by the British Thomson Houston Co., Ltd. **Mr D. N. de Mattos,** B.SC., GRAD.I.E.E., GRAD.I.M.E., has recently moved to Bristol as sub-district manager of the BTH district office there; **Mr B. Barton,** ASSOC.I.E.E., who until recently was on the staff of B.T.H. Manchester office, now holds a commercial engineering appointment at Crown Hse, Aldwych W.C.2; and finally, **Mr E. R. Seaden,** B.SC (ENG.)., ASSOC.I.M.E., F.Z.S., who for six years has been on the lighting-engineering staff of the company, has been posted to the Industrial Sales Division of B.T.H. London office as a commercial engineer. Mr de Mattos has been on commercial engineering duties at the company's London office for the past two years after serving in a similar capacity at the Manchester office.

Following the retirement at the end of this year of **Mr John Ireland, Dr Ernest S. Hedges** will become director of the International Tin Research Council and director of the Tin Research Institute. **Dr W. E. Hoare** and **Mr W. R. Lewis** have been appointed assistant directors.

Changes in the organisation in the office of the assistant electrical engineer (generation) of London Transport are announced. **Mr J. Collins,** B.SC.(ENG)., who is now generating station superintendent at Greenwich, has been appointed to a similar position of the Lots Rd power station; **Mr W. Ward,** M.INST.F., now generating station superintendent at Neasden, succeeds Mr Collins in a similar capacity at the Greenwich power station, and finally, **Mr G. F. Withers,** M.INST.F., takes over the post of generating station superintendent at Neasden vacated by Mr Ward. Mr Withers, who is now assistant generating station superintendent at Lots Rd, served an apprenticeship with Edmundsons Electricity Corporation Ltd., subsequently being employed for five years with Babcock and Wilcox Ltd. He joined the London Electric Railway Co. in July 1928 as a combustion engineer at Lots Rd generating station.

Mr E. H. Ball. M.I.E.E., a director of Associated Electrical Industries Ltd., and managing director of the British Thomson-Houston Co., Ltd., has been elected chairman of Birlec Ltd., the Birmingham furnace manufacturing concern recently acquired by A.E.I. Also elected to the board of Birlec are **Mr W. W. Vinsen,** director of manufacture, the British Thomson-Houston Co., Ltd.; and **Mr E. S. Little,** comptroller and secretary of B.T.H. These three new directors join the existing executive directors, **Mr George P. Tinker** (managing), **Mr T. G. Tanner** and **Mr J. H. Crossley.**

Cable and Wireless Ltd. have appointed **Mr R. C. F. Saxby** as contracts manager as from 1 Jan. next, in succession to Mr H. V. Higgitt who retires on 31 Dec., after 42 years' service with the company. Mr Saxby, who has been assistant contracts manager since 1947, will be succeeded by **Mr G. W. T. King,** who has been in charge of the company's Insurance, Shipping and Accounts Section since 1941.

Mr T. H. Bertram, chief electrical engineer for No. 3 Area of the Northern (N. and C.) Coal Board, had been transferred to a similar position with No. 1 Area. Mr Bertram began his career as an apprentice electrician at Stobswood Colliery.

Just joined the technical Publicity Department of the British Thomson-Houston Co., Ltd., at Rugby, is **Mr G. A. T. Burdett,** A.M.I.I.A., M.I.A.M.A., who, for the past two years, has been publicity manager of Holophane Ltd. Mr Burdett was a sales engineer with Central London Electricity Ltd., and the North Wales Power Co., prior to the war, and was one of the first recipients of the E.D.A. Sales Engineers Diploma. After the war he had editorial experience with Odhams Press, and following a period as public relations officer with the Plessey Co., was appointed manager to the Dowsett group of companies. For a time he was then with the Service Advertising Co.

Mr F. C. Platt. M.M., M.I.E.E., retires on 31 Dec. next after 33 years' service as power engineer with Guest, Keen and Nettlefolds (Midlands), Screw Division.

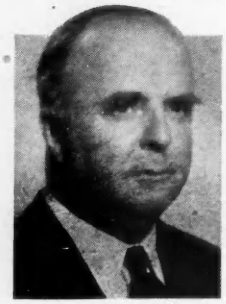
Previously with W. T. Henley's Telegraph Works Co., Ltd., **Mr J. J. Davies** has been appointed publicity manager of

Mr D. N. de Mattos

Mr B. Barton

Mr E. R. Seaden

[Mr E. H. Ball



Mr W. W. Vinsen

Mr W. A. Turner

Mr Charles Johnson

Mr John Meek

Holophane Ltd. He has had long advertising experience in the electrical manufacturing and agency fields; with Holophane he will be responsible for advertising and public relations, exhibitions and printed matter. Mr Davies succeeds **Mr G. A. T. Burdett** who, as we note on p. 928, has joined the Publicity Organisation of the British Thomson-Houston Co., Ltd.

Sales manager to L. G. Hawkins and Co., Ltd., **Mr Charles Johnson** has now been appointed to the board of directors of the company.

To mark his retirement after 40 years' service, first with Swindon Corporation, and after nationalisation, with the Southern Electricity Board, **Mr H. Grimes,** development engineer, Swindon district, was last week the recipient of a presentation made on behalf of the staff by **Mr F. A. Ellis,** M.I.E.E., M.I.MECH.E., manager of the Board's No 2 sub-area.

For the new South of Scotland Electricity Board, **Mr John Meek** has been appointed secretary. Since 1948 Mr Meek has held a similar position with the South West Scotland Electricity Board. He qualified as a solicitor in 1922, and between 1937 and 1948 was town clerk deputy to the Corporation of Glasgow.

The North of Scotland Hydro-Electric Board have appointed **Mr H. W. Simpson,** M.A., LL.B., at present deputy secretary, to be secretary to the Board as from Jan. next and **Mr J. C. N. Baillie,** M.I.S.M.A., M.I.B.A.E., M.A.S.A.E., at present their development engineer, to be chief commercial officer. Born at Deskford, Banffshire, Mr Simpson was educated at Dunfermline High School and at the University of Edinburgh where he graduated and thereafter qualified as a solicitor. He was previously Quaestor and Factor and Solicitor to the University of St Andrews, becoming assistant secretary to the Board in 1944 and deputy secretary in 1948. Mr Baillie was born at Coatbridge and received technical training at Coatbridge Technical College. After service with the Clyde Valley Electrical Power Co. and the Buckrose and South East Yorkshire Light and Power Co., Ltd., he joined the Board in 1946. **Mr W. D. D. Fenton,** M.I.E.E., the Board's present secretary and commercial engineer, leaves on 20 Jan. to take up his new post of deputy chairman of the Uganda Electricity Board.

Mr W. A. Turner, B.SC.(ENG.), M.I.E.E., has been appointed principal of the School of Electronics which Automatic Telephone and Electric Co., Ltd., has established at Liverpool The school should materially help meet the company's increasing need for competent research, development, design and production engineers. Mr Turner held various appointments as a lecturer at important educational establishments before going to Brighton Technical College in 1950 as Head of the Electrical Engineering Department. He started his career in industry, serving an apprenticeship in electrical engineering, and thereafter becoming a design-estimating engineer with British Thomson-Houston Ltd. at Rugby. He has developed a special interest in servo-mechanisms and has given advanced courses of lectures at several centres.

Babcock and Wilcox Ltd. announce that, in view of their expanding activities in Latin America, **Mr A. S. Peacock** has been appointed as manager for that territory, with general responsibility for the company's business in Latin America, including factory development in Brazil and co-ordination of policy. The appointment takes effect from 1 Jan. next.

The Covered Conductors Association have re-elected **Mr G. E. Jewell,** of the London Electric Wire Co. and Smiths Ltd. as chairman, and **Mr G. F. Travis,** of Connolly's (Blackley) Ltd., as vice-chairman for the ensuing year.

Formerly engineering maintenance superintendent at the Rockware Glass Co.'s Greenford (Middx.) Works, **Lt.-Comdr (E.) A. N. Tipper** (ret.) has been appointed works engineer (Greenford) and will be responsible for electrical building and engineering services and plant as from 1 Jan. next.

At last week's board meeting of Electric and Musical Industries Ltd., **Sir Alexander Aikman** indicated his desire not to stand for re-election as chairman. **Mr J. F. Lockwood** was appointed chairman in his place, but Sir Alexander remains a member of the board.

OBITUARY

Admiral Sir Wilfrid Patterson, who was a director Axia Fans Ltd and of Vent-Axia Ltd., died on 15 Dec. aged 61.

Mr W. V. Green, area manager for British Insulated Callender's Cables Ltd., died in Gloucester a few days ago.

BRITISH STANDARDS

Graphical Symbols for Electrical Purposes. *Amendment Slips PD* 1952 (*to B.S.* 108) *and PD* 1953 (*to the Supplement to B.S.* 530). *Gratis.* For defining and identifying components, circuit diagram users employ code letters and component references as specified in either B.S. 108: 1951 (Graphical Symbols for General Electrical Purposes) or the Supplement to B.S. 530:1950 (Graphical Symbols for Telecommunications) whichever is applicable. Each standard, however, reflected conventions which had grown up in the field of technology concerned, with resulting inconsistencies between the two. However, the simultaneous publication of an amendment to each standard removes these differences.

Air-cooled flameproof single-phase lighting transformer units supplied from high voltage systems. *B.S.* 2588: 1954. *Price* 2*s.* Prepared at the request of the National Coal Board, this new standard applies to lighting transformers, complete with protective fuses and primary isolator, intended mainly for use in coal mines for roadway lighting. Such units, however, may be used in other situations where inflammable gas or vapour is likely to be present in the surrounding atmosphere. The units referred to are those designed for supply voltages of 2,200, 2,750 or 3,300 V with ratings of 2·5 and 5 kVA, and having secondary voltages of either 125 and 250 V or 115 and 230 V. Provisions for earthing, incoming and outgoing cables, primary isolating switch and fuses and outgoing circuits are specified apart from the actual transformer, and a number of tests are laid down.

Electric boiling-plates for domestic purposes. *B.S.* 744: 1954. *Price* 3*s.* 6*d.* In this revision are specified requirements for the construction and performance of sheathed-element type and cast iron enclosed type boiling-plates for domestic purposes, which are intended for operation on voltages not exceeding 250 V. There is a comprehensive section dealing with the methods of testing, which gives information on leakage current, dielectric strength, thermal efficiency, endurance, thermal shock and other tests. A further section specifies the method of marking boiling-plates to comply with the requirements of the Standard, and an appendix gives information on controlling the humidity of atmosphere when carrying out an insulation resistance test.

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Tracking Fuse

A PLANT attendant in a power station reported that the hoist motor would only move in the down direction. The controller was contactor operated and at first a blown contactor coil fuse was suspected. These proved, however, to be in order so further tests had to be carried out. A neon lamp test at the mains coming into the contactor panel gave indication of equal brilliance to earth from each phase, similar conditions obtaining at the minor fuseboard supplying the hoist and a conveyor, the latter running correctly.

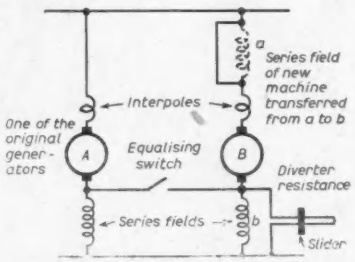
It was then decided to use a voltmeter instead of the test lamp and the following was discovered. Two phases in the contactor board gave 230 V to earth while the third gave only 170 V. The same readings were obtained at the minor fuseboard, so a check was taken further back at a major power board fitted with h.r.c. fuses and supplying other plant which was apparently running correctly.

Again the readings were the same, so a check was made on the outgoing side of a set of heavy h.r.c. fuses that supplied the major board and the cause of the trouble was located at last. One of the fuses had failed through deterioration and had left enough tracking to pass enough current to keep plant running and also to enable the hoist motor to start downwards, when minimum current was required When the raise signal was given the current demanded was 40 amps and the tracking was just not heavy enough to meet it.—*H. T. Williams.*

Paralleling Generators

IN the issue of October 14 reference is made to the difficulty of paralleling d.c. generators. It is considered that the omission of the series coil windings would not help much to solve the problem, for although designs vary, the ratio of series to shunt field amp-turns is often such that without the series field flux, the shunt characteristic would operate below or near the knee of the curve and instability would be introduced by armature reaction. It is suggested that, if both shunt regulators are of the same design, the regulator arms be placed on identical contacts, the machines then be run separately and the brush rockers shifted slightly so that both machines give identical voltages. If there is still an interchange of load when parallel with the equalising switch made first, then I suggest that procedure on the lines of the following experience I had may prove advantageous.

A small factory for processing liquid rubber latex was equipped with two identical generators of 25 kW each. An additional generator was required and as one of similar make could not be obtained, a smaller generator of 15 kW was purchased. The first operation necessary was to transpose the series field winding of the new machine in order to give the correct polarity with respect to direction of rotation, and to match up with the disposition of the series and interpole coils and armatures of the original machines. This was in order to provide for an equalising connection at the correct point. The diagram shows the connections, with shunt field coils, shunt regulators and circuit breakers omitted. The new machine, when run up and put on the busbars, overloaded and tripped out when parallel. It was then decided to fit a diverter resistance to the new machine



Rearrangement of circuit necessary to ensure correct operation of two generators in parallel

arranged as shown in the diagram. To ascertain the necessary resistance to divert, or shunt the series windings, I first experimented with a low resistance of the grid type. When the correct resistance was ascertained to allow the machine to take a full proportionate load, the resistance was measured with a "Ducter" and a more compact resistance of "Ferry" resistance strip made up and accommodated at the back of the machine.

A resistance material of adequate sectional area and of a low temperature resistance coefficient should be chosen to minimise increase of resistance when heated. An alternative method for ascertaining the correct value of the diverter resistance would be to ascertain the length of the resistance strip by the slider method and then make a new one of the same length and material.

It is interesting to note that the two identical generators of continental manufacture were both fitted with diverter resistances and whether this was due to trouble experienced when first installed, or whether it is continental practice, I cannot say. However, the equalising connections, which extended to an equalising bar on the switchboard, were of good length, and of course the equalising connections and switch should be of as low a resistance as possible.

With respect to the drivers, all three machines were best driven by oil engines and here we meet the crux of the problem as set by "J.P." This type of drive gives a certain amount of flexibility to the input to the generators, whereas a.c. motor drives, with flywheel effect, place the onus of equalising on the generators themselves. However, large rotary converters of different sizes with the same synchronous speeds all run in parallel without much difficulty.

He also mentions the possibility of "regenerative breaking effect" on the driving motors but it is extremely unlikely that a generator would "overdrive" its motor, and if it did the only result would be an improvement in the power factor of the driving motor. Even identical compound generators often vary in their characteristics and I suggest the trouble "J.P." has experienced is mainly due to this factor.—*K. Coombs.*

Farthed Neutral

WHILE carrying out an electrical inspection at a house in Islington, London, I met rather unusual circumstances. The recognised insulation tests were taken from each pole to earth, and also between poles on the various circuits. On obtaining infinity, and also good earth continuity, including the various conduit laterals, I was prepared to give the installation of a clean bill of health. By chance, or maybe a sixth sense, however, I took a further insulation test from the distribution board, and was surprised to find a very low reading on the live side of one circuit. Enquiries showed that the tenant had just switched on a radio set, and it was immediately assumed that this was faulty. On testing the set, however, I found it to give an infinity reading for insulation to earth. Moreover, the set itself was not even earthed so I had to look further afield for the reason for the low resistance to earth.

Removal of the switch plug used for the radio revealed that it was fed from the live side of a local lighting switch, with the neutral socket connected to the adjacent conduit. It would seem, therefore, that normal insulation tests would not have disclosed this incorrect and dangerous method of connection. The only satisfactory method of testing would

then be to take a separate insulation test from every switch plug neutral pin to earth, as, with the above connection, this pin is isolated from the circuit wiring, unless connected through some piece of apparatus to the live pole.—*L.W.S.*

Installation Practice

IN the issue of 25 Nov. W. Satchwill comments on my method of re-using existing conduits when re-wiring with p.v.c. sheathed cable. His statement that there is little difference in size beween p.v.c. and t.r. sheathed cables is only true when these cables are insulated with rubber as specified in B.S.7. If he would use polythene insulated, p.v.c. sheathed, cables complying with B.S. 1557, he will find that their overall dimensions, for the same conductor size, are much thinner than those made to B.S.7. Two twin (1/044) cables of this type are easily accommodated in ½ in. close joint conduit.

The remarks on earthing such conduits merit attention. Among exemptions is I.E.E. Regulation 1001 (A) sub-clause (ii) and reads as follows: "Short isolated lengths of metal conduits used for the mechanical protection of metal-sheathed or tough rubber or p.v.c. sheathed cables ..." There is undoubtedly a certain vagueness of the word "short" used in this context and particularly as to what length it refers to—in other words how long is short! In order to obtain a more precise definition I recently wrote to the I.E.E. Wiring Rules Committee and the reply I think will be of interest to installation engineers. It runs, "It is impracticable to state a precise limit for the length of short lengths of metal conduit installed in accordance with Regulation 1001 (A) exemption (ii). It has been ruled, however, by the appropriate Committee of the Institution, that a length of the order of as much as 10 or 12 ft, containing no junction box or tee-piece and used solely for mechanical protection of sheathed cable, could fall within terms of this exemption." In view of the above, I would maintain that the method I advocated is superior.—*M.N.*

* * *

IT is certainly interesting to learn that short lengths of conduit may be up to 12 ft in length. I would still not advocate the non-earthing of conduits in this particular situation however, as close joint conduit affords little protection against carpenters' nails. It is not uncommon to find such conduit pierced by cut nails, and if, under these circumstances the nail also penetrated to insulation of a phase cable, the fuse would not blow but the nail would become alive—not a pleasant proposition for anyone washing the floor. A metal plate would give far better protection.

On the first part of his comment, it is necessary to point out that I was referring to rubber insulated, p.v.c. sheathed cables.—*W. Satchwill.*

(This correspondence is now closed.—Ed).

NEW LITERATURE

Introductory Circuit Theory

by E. A. Guillemin.

ALTHOUGH this book may be regarded as a single entity, it is, in fact, the first of a contemplated series dealing with circuit analysis, and hence, as is explicit in the title, only provides an introduction, albeit an exhaustive introduction. For the advanced engineering student planning to specialise in circuit and network analysis, however, this work is admirable, bearing in mind the American background against which it is written. Its opening chapters present the subject of establishing equilibrium equations for networks using resistance networks as a basis. Volt-ampere relationships are then introduced, the characteristics of both circuit elements and sources being discussed. This leads naturally to a consideration of response of circuits to impulse, step and finally sinusoidal functions, consideration of the latter occupying a substantial section of the book. Additional topics related to steady state and transient behaviour are then dealt with, with a generalisation of circuit equations and energy relations as the concluding chapter. Published by Chapman and Hall, 550 pages, 9 in. by 6 in. Price 68s.

Electrical Earthing and Accident Prevention

ed. by M. G. Say, PH.D., M.SC., M.I.E.E.

EARTHING is in its essentials the simplest of ideas. Yet in practice, the earthing of electrical equipment and installations becomes all too easily a comparatively complicated task, involving a choice between several possible techniques. In this valuable book on the subject a number of experts discuss briefly the problems of earthing, and of obtaining protection against shock by alternative means. Separate sections are devoted to individual problems. There are separate contributors on power system earthing, domestic, industrial, ship, traction, mining, aircraft, and telecommunication installations, and also on many types of consumer equipment. In every case a useful practical approach is adopted that should be welcomed by electrical engineers generally. Supporting this detailed information are some chapters of general interest. Mr H. W. Swann surveys the whole question of accidents and their prevention and other authors deal with earthing regulations and with measurements and maintenance in connection with earthing equipment. This last section includes some useful nomograms. Finally, there is a chapter on lightning protection. Published by Newnes, 248 pages, 8¼ in. by 5¼ in. Price 25s.

World Railways (1954-55)

Ed. by Henry Sampson.

TO the reader of the two previous editions of this comprehensive survey, the third may appear to be less widespread. Two factors contribute to this, the first being the restriction of photographs to those which are representative of good modern practice, and the second is the rearrangement of the book to provide a better access to fundamental data, yet at the same time to include information on recent forms of motive power. Thus much dead wood, of interest mainly to the railway antiquarian has been eliminated. This is no loss: railways remain the most vital land communication agent and any attempt to accelerate their development on an economic basis is of vital importance to civilisation. In this task "World Railways" can play a significant part. Comparisons may be odious, but the comparisons readily found in this volume are also stimulating, and more than ever it is now a vital part of the library not only of the railway engineer but of all interested in rail transport. Published by Sampson Low, Marston and Co., Ltd., 25 Gilbert St, London W.1. 462 pp., 8¼ in by 12½ in., Price 84s.

BOOKS RECEIVED

Power Today and Tomorrow, by F. Sherwood Taylor. Primarily for the lay reader, it discusses modern power sources and their application to human needs. Published by Frederick Muller Ltd., 192 pages, 7¼ in. by 5 in. Price 15s.

Electric Wiring (Domestic), ed. by E. Molloy. New edition of this popular wireman's book has been thoroughly revised and information brought into line with the 12th edition of the I.E.E. Regs. Fifth edition, published by Newnes, 268 pages, 7¼ in. by 4¾ in. Price 8s. 6d.

Linear Transient Analysis, Vol. I, by E. Weber, Encyclopædic in character, it discusses all methods of transient analysis for the engineer. Published by Chapman and Hall, 348 pages, 9 in. by 6 in. Price 60s.

Control System Dynamics, by W. R. Evans. Demonstrates the techniques for determining the response of linear control systems for both engineers and students. Published by McGraw-Hill, 282 pages, 9 in. by 6 in. Price 20s.

Tables of Hygrometric Data for Air. Prepared by I.H.V.E. from its guide to current practice, covering, in this new edition, range of 140° F to 300° F dry bulb. Also includes two physchrometric charts and a hygrometric monogram for dry bulb temperatures. Second edition, published by Institution of Heating and Ventilating Engineers, 49 Cadogan Sq, S.W.1. 70 pages of tables, 6 pages text, 9 in. by 5¾ in. Price 10s.

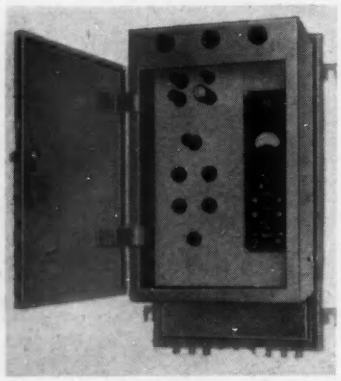
Electricity Undertakings in Natal. Volume 5 of the Natal Regional Survey, presenting an overall picture of generation and supply in the province, with details of supply voltages and tariffs. Published for the University of Natal by the Oxford University Press (London: Geoffrey Cumberlage), 100 pages, 8¼ in. by 5¼ in. Price 25s.

Equipment for Industry

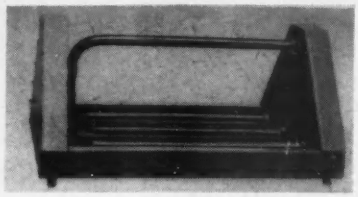
Non-ferrous Metal Detector

ALTHOUGH the installation of a magnetic separator is sufficient to overcome difficulties caused by tramp-iron, in many instances it is essential also to remove metal which it is not possible to detect by magnetic means and yet is liable to be just as damaging as the iron. Specially designed to overcome this source of trouble, a new equipment produced by METAL DETECTION LTD., Moseley St, Birmingham 12, can detect both magnetic and non-magnetic metals and is said to have been proved in service over a 5-year period. Already being used on conveyors of such diverse materials as tobacco and coal, the apparatus is said to be completely dependable.

An installation consists of two major components, a search coil and a control cabinet. An oscillator in the control cabinet sets up a high-frequency electromagnetic field in the coil unit, and with no metal in the field, the system is adjusted to give a zero signal. Any metal now passing through the search coil disturbs the balance and the resultant signal, sent to the control cabinet, is arranged to operate some diverting apparatus, or warning system. In view of the situations in which both items of the illustrated equipment are likely to be used, particular attention has been paid to the weather-proofing and general mechanical design to ensure that it will meet the arduous conditions imposed by outdoor service. The search coil unit comprises two mutually perpendicular coils, each a single turn of heavy gauge copper tube as in the illustration below. These coils are arranged so that one lies under the conveyor or chute and the other completely surrounds it. A feature of this unit is that the conveyor may be left undisturbed whilst the search coil is being fitted since the latter is easily dismantled for this purpose. The control cabinet houses, in addition to the oscillator which produces the magnetic field, an amplifier for the signals sent by the search coil, and a relay which is controlled by the amplifier. An arrangement is provided whereby valves may be individually checked to ensure correct operation. The equipment is available in two sizes to suit light or heavy duty conveyors.



The control cabinet used in conjunction with the search coil, is robustly constructed to meet the requirements of outdoor service



The search coil referred to above is easily fitted without disturbing the conveyor

Uses for "Epikote" Resins

RECENTLY introduced, the technique of "potting" miniature assemblies and other equipment such as transformers and capacitors is rapidly becoming an established practice. However, the reliability of components treated in this way depends entirely on the quality of the resin which is used as the casting medium since not only does it have to have good electrical and thermal properties, it must also be able to withstand mechanical shock. SHELL CHEMICALS LTD., 105 Strand, W.C.2, are now manufacturing a resin derived from petrol, which is claimed to be particularly suitable for "potting." Equipment treated with this 'Epikote" resin, as it is called, is made quite waterproof by the "potting" process such that it is possible completely to immerse equipment in water and still have satisfactory operation.

Another important development, is the use of "Epikote" based finishes for refrigerators and other domestic equipment. Due to the reduced number of coats required to obtain a finish comparable with that produced by using standard finishes, the high initial cost is offset and overall expenditure is said to be almost the same for both types. Claims for "Epikote" based coatings are a combination of the adhesion, flexibility, toughness and other features desired of a finish, and that although such coatings are derived from a petrol base, the characteristics change to such an extent during processing that the fire risks are said to be less than those expected from nitro-cellulose lacquers. In addition, in this respect, they are said to be as good as other lacquers or paints and to have superior heat-resisting qualities.

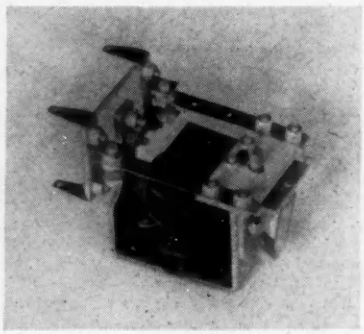
U.S. Valve Equivalents made in U.K.

TO meet the demand for British-made equivalents to American thyratrons, MULLARD LTD., Century Hse, Shaftesbury Ave., W.C.2, have produced a range of nine different sizes. Since the war, much industrial electronic equipment has been purchased in the United States, therefore the need for replacement components has increased accordingly. In addition, now that the position has changed and electronic equipment is being exported to dollar countries, in order to facilitate servicing it is reasonable to install valves which may be easily replaced in the receiving country. Of the nine thyratrons manufactured, two are for use in relay control or other light current circuits and where higher currents are employed as in motor or process control circuits, five of the remaining valves are suitable, two being of the rare-gas type. The last two are cold-cathode relay tubes.

Universal Low-power Relay

WITH their new miniature-type MIR relay, the ELECTRICAL REMOTE CONTROL CO., LTD., Elremco Works, Harlow New Town, Essex, claim to have considerably reduced costs by direct mounting of the contacts on to insulating panels. The economies in manufacturing costs effected are said to have enabled the firm to use high quality materials and yet still maintain the unit at a reasonable price.

The relay consists of a "U"-shaped yoke supporting the operating coil, which is suitable for operation on either 440 V a.c. or 110 V d.c., or where current operation is required, may be wound for up to 10 A. The contacts, which are arranged for double-pole changeover as standard, may be supplied for up to 4-pole changeover where required. Metal finish cadmium plate. Four 6 BA fixing holes are provided.



Economies in manufacturing costs have been achieved with this relay

"Klippa" Lamp for Convenient Light

THE neat "Klippa" lamp illustrated below is the answer to many domestic lighting problems. With its spring loaded clip and flexible column coupled with light weight, the lamp is excellent for reading, sewing, televiewing, for the children doing home work, and for use in the workshop, for model making, and in home hobbies, in fact anywhere where adequate light on the spot is the order of the day.

DUNCAN PARTNERS AND PRICE LTD., 55 Uxbridge Rd, W.12, illustrate in a leaflet the versatility of this lamp, which can hang from a wall, stand free on a table as a reading light, or with reflector turned upwards, serve as a TV lamp, can be positioned as a spotlight, clipped on to a shelf, or dressing table to give light anywhere. The modern ventilated shade is stove enamelled in colour, the through-switch being at the base of the flexible stem and the price 17s. 6d. plus 2s. 11d. p. tax.

TRADE PUBLICATIONS

CATERING.—"The economy of employee feeding" by H. V. Black F.R.S.A. has been published by Intel (Caterers) Ltd., 2 Parkshot, Richmond, Surrey, as their thirteenth booklet on employee feeding.

TRANSFORMERS.—New catalogue sheets issued by Foster Transformers Ltd., South Wimbledon, S.W.19, include "Technical College transformers" and "Portable tool and lighting transformers" together with their relevant price sheets.

PRIME MOVERS.—A pocket booklet describing the entire range of petrol, diesel and TVO engines by Petters Ltd., Staines, is now available.

LIGHTING.—Catalogue No. 460/55 issued by Wholesale Fittings Co., Ltd., 46-52 Commercial St, E.1, gives up-to-date information on equipment available.

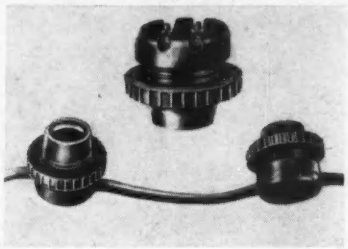
ALLOYS.—A new data sheet on Monel second in the new series is available from Henry Wiggin and Co., Ltd., Thames Hse, Millbank, S.W.1.

Nettle Striplight Modified

TWO new products just introduced on the market by NETTLE ACCESSORIES LTD., Harper Rd, Wythenshawe, Manchester, are further developments of the company's all moulded rubber striplight.

In our illustration are shown two Edison screw striplight holders fitted with a heavy bakelite moulded ring. These are intended for use on sign illumination where the body of the holders can be pushed through a suitably drilled hole and clamped into position by means of a front locking ring. In the centre the lampholder shown is a rewireable type with back terminals exposed. In each case, the glass envelope of the lamp when screwed into position seals itself against the top of the lampholder and forms a watertight seal.

The new striplight lampholder



Wye Valley Blanket

NEW venture for WYE VALLEY HAND WEAVERS, Ross-on-Wye, Herefordshire is a 54 in. by 30 in. electric blanket now marketed at £4. 18s. 9d. (inc. postage and 15s. 7d. tax).

The inner core is made entirely by hand, the asbestos-covered heating element being woven in at the same time as the core is made, a feature making for strong and safe construction.

The cover itself is an ordinary soft warm blanket, whilst there is available a fine white cotton cover, removable for washing at 16s. extra post free. The blanket is rated at 88 W for a.c./d.c. supplies in voltage ranges 220/250 V and 200/210 V. It is covered by 12 months' guarantee and fitted with 9 ft flexible cable, improved switch and b.c. adapter.

The exterior views show the S313 and L72 (the latter is similar to L52) whilst interior views are of the S313, L52 and L72 showing differing capacities and internal arrangements

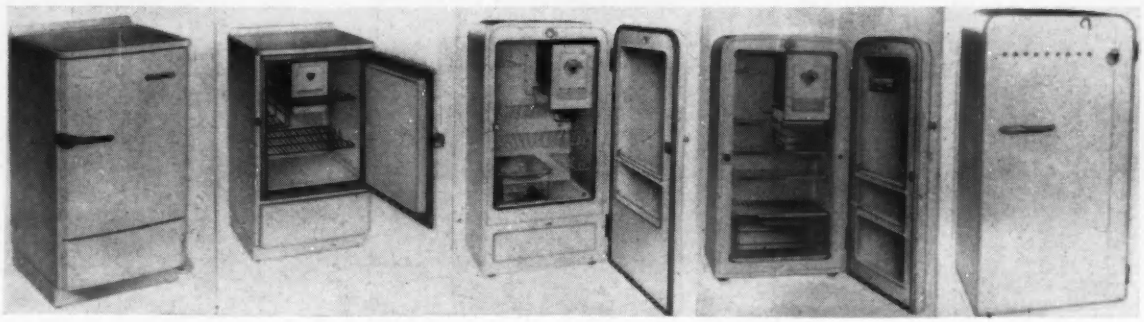
For the Electrical Trade

Prestcold 1955 Range

THREE new domestic models embodying latest refinements in style and efficiency are announced by THE PRESSED STEEL CO., LTD., Cowley, Oxford.

Developed from the existing range and redesigned for the greater convenience of the user, all models are powered by the Prestcold hermetically-sealed system which carries a five-year guarantee and are available in two colours, white and cream. First model is S313 a 3·1 cu ft table top model with spill guard around edge of 2 sq ft top. It has a one-piece vitreous enamelled liner; has a door to the cooling unit which improves the internal appearance and assumes steady temperature in the evaporator which has ample capacity for ice cubes, frozen foods and ice cream. Convenient for the small kitchen is the re-arranged door which even when fully opened remains flush with the cabinet. Price is 63 gns. inc. p. tax.

The L52 and L72 models are of differing capacities (5·5 cu ft and 7·2 cu ft), L52 has a frozen food locker, with two ice trays, of 12 lb capacity, whilst the L72 has a 22 lb food locker. The shelves are adjustable to make the greatest use of interior space. Door shelves and automatic interior lighting are common to both models, whilst the larger model has a butter compartment in the door. The white version of these two models has ice-blue trim and the prices are 99 and 119 gns. respectively inc. p.t.



NEWS OF THE WEEK

Bigger Demand Raises U.K. Output

MANUFACTURERS STILL HOLD EXPORT LEAD ON GERMANY

FURTHER evidence of increased industrial output in the U.K., especially in the electrical industry is provided by the Treasury's Bulletin for Industry, the latest issue of which compares our own industrial efforts with those of other West European countries, particularly Germany. Our advance in the first half of this year corresponded to that of W. Europe as a whole. It was much the same as that of France, Belgium and Holland but below W. Germany's increase of 11%. A very substantial contribution to the total increase in production in this country came from the electrical industry. Output in the first half-year was 7½% up on 1953, although the quarterly rate did not attain the heights achieved in October, November and December of 1953. The survey draws attention to a significant difference between capital and consumer goods. Domestic equipment and radio sets are mentioned particularly as having contributed markedly to the rising output. Main factor governing production has undoubtedly been the increased demand, a matter already dealt with at some length in our 4 Nov. issue. Personal consumption at home has been about 3% higher this year although this rate of increase may well have risen in the last two months. The volume of exports has also risen by some 9%.

Both U.K. and German exports are higher this year than last but it is notable that Germany's rate is far greater than our own. Nor are there any signs of a slackening in the German export drive. If this does not appear encouraging, no blame can be attached to the electrical industry for this situation. While it is true that the Germans are exporting as much non-electrical machinery as ourselves, in electrical machinery we still hold a formidable lead.

It should be remembered also that the markets involved are very different. The German export trade is linked with the prosperity and demand in neighbouring countries, which have expanded more in the past four years than the sterling area where our trade lies. Then again our place in the U.S. and Canadian markets is much larger than that of Germany, and our exports are some two or three times greater. In S. America Germany has replaced the U.K. as the second largest supplier to the U.S. It is notable too that we hold a good lead in the Middle East.

In total, however, the U.K. is still exporting 40% as much again as Germany, and we are proving time and time again that we can meet the German challenge. There is no room for complacency—it will be a difficult task to maintain our position and there is plenty of scope for improvement especially in the field of sales promotion.

Three Electrical Firms Join British Group to Help in Development of India

THREE electrical manufacturers have announced that they are joining the British Group which is to participate in the Industrial Credit and Investment Corporation of India, to the extent of 1½ lakhs of rupees (£10,000) each. They are Associated Electrical Industries Ltd., the English Electric Co., Ltd., and the General Electric Co., Ltd.

Participation of U.K. subscribers to the new Indian Corporation was, as previously stated, arranged through the Commonwealth Development Finance Co. and included the principal Insurance Companies operating in India, together with the eastern exchange banks and certain industrial organisations having interests in that country. The present announcement makes it clear that the three major heavy engineering companies mentioned above are taking part directly as foundation shareholders in the new Indian Corporation, in addition to their indirect interest in the Corporation through their respective shareholdings in the Commonwealth Development Finance Co.

It will be recalled that the Bank of England announced recently that Mr P. S. Beale, Chief Cashier, was resigning from its service to take up an appointment as the first general manager of the Corporation, early next year.

Power Link between England and N. Ireland suggested

IN the course of discussion at last week's meeting of the I.E.E.'s N. Ireland centre, Belfast city electrical engineer, Mr R. P. Watson suggested a power link between Ulster and Britain. The meeting had just heard a paper on the cross-channel link between England and France, prepared by Messrs F. J. Lane, D. P. Sayers and M. E. Laborde. Mr Watson asserted that as it cost about 10s. a ton to take coal from Ayr to Belfast power stations, the financial saving would be considerable if his suggestion was adopted. He added, however, that he appreciated the question of reciprocity was a snag. The load factor in both Britain and N. Ireland was almost identical, and consequently almost all the benefit from such a link-up would be on Ulster's side. In his reply, Mr Lane said the question was well worth examining.

Increase in Business causes Policy Change

A MAJOR change in policy affecting their distribution arrangements has followed a large-scale advertising campaign conducted by L. G. Hawkins and Co., Ltd., during 1953-54. This national publicity programme cost the company over £50,000. Its results fully justified such an expenditure, however, as it greatly accelerated an already steady expansion in trade. Business became so brisk that some alteration in their trading arrangements became imperative, and consequently they asked nearly all their customers to obtain products and spares from stockholding wholesalers. Hitherto all business had been transacted directly between manufacturer and customer. Nearly 10,000 retail accounts were dealt with in that way. Only a few direct accounts have been retained.

The company's representatives (there are ten covering the country) will continue to call personally on customers to show new products, maintain supplies of publicity material, and to take orders. Such orders will be passed to appointed wholesalers for immediate delivery from stock. All orders received by post (except customers still dealing direct) will also be passed to the local stockholding wholesaler. The company will continue to circularise all retail customers.

Railway Electrification

ALTHOUGH no information has yet been officially released on the proposals for the reorganisation of the railways, much speculation is appearing in the National Press as to the implications involved. Most of this appears to be based on the last report of the British Transport Commission, and envisages a considerable increase in railway electrification and the extensive use of diesel motive power. It is, however, understood that the proposals will be made public within the next few weeks and will, of course, be dealt with fully in our pages.

More Evidence on Supply Industry

EXTRA control of generating and transmission costs is the subject of yet another recommendation submitted as evidence to the committee of inquiry into the electricity supply industry. This latest plea comes from the National Union of Manufacturers who ask for a national electricity consultative council to represent industry, commerce, agriculture, labour and local authorities. The Union state that existing area consultative councils have no effective control over the cost of generation and transmission, which accounts for some two-thirds of the total cost incurred.

Industrial Committee formed by E.D.A.

A NEW committee has been inaugurated by the Electrical Development Association to promote the use of electricity in industry. An announcement issued last week states that the committee will consider steps to be taken to foster and develop the use of electricity in industry, and make recommendations to the Council on the subject. The committee held their first meeting on 15 Dec. and elected Mr L. Howles, chairman of the S. Wales Electricity Board, as chairman, and Mr J. F. Smith, chief commercial officer with the same Board, as vice-chairman.

There will be 16 other members of the committee representative of the other Area Boards, the B.E.A. and the Electricity Board for N. Ireland. Representatives of the N. of Scotland Hydro-Electric Board and the S. Eastern Board have still to be nominated. The 14 who have been nominated include Mr V. A. H. Clements, assistant commercial manager, B.E.A., and Mr A. W. Ferguson, chief administrative officer for N. Ireland. The Board's are represented by Mr F. C. Fenton, Mr W. B. Poulter, Mr E. A. Fowler, Mr A. Haselhurst, Mr A. O. Johnson, Mr. J. W. Moule, and Mr J. Gogan, chief commercial officers with the London, Southern, Eastern, Yorkshire, N. Western, and S.W. and S.E. Scotland Boards; Mr N. C. Metcalfe, assistant chief commercial officer (tariffs) S. Western Board; Mr W. J. Watson, section head (industrial supplies) E. Midlands Board; Mr E. H. Hubberd, industrial officer Midlands Board; Mr W. B. Parkinson, industrial development officer, Merseyside and N. Wales Board; and Mr R. M. Muckart, of the N.E. Board's chief commercial officer's industrial department.

CASES IN COURT

Institute of Fuel fail to gain Rating Exemption

THE Court of Appeal last week dismissed the Institute of Fuel's appeal against a decision of the Lands Tribunal which affirmed a local valuation court's decision that the Institute was not entitled to exemption from rating. The Institute had contended that they were entitled to exemption because they were a society instituted for purposes of science exclusively within the meaning of the Scientific Societies Act, 1843. Giving judgment, the Master of the Rolls said it was assumed that the Institute was a society established for the purposes of science, and the sole question was whether it was established exclusively for that object. The Crown contended that the Institute covered aims other than scientific ones. He pointed out that the charter included the persuasion of the public to economise fuel by using recommended appliances. Another object was to enhance the status of fuel technologists as professional men. In his view, therefore, the tribunal's decision was correct.

Lord Justice Jenkins dissented, saying that a distinction should be drawn between the objects of the Institution and the means adopted to attain those ends. On the other hand Lord Justice Birkett agreed with the Master of the Rolls. He said the objects of the Institute were in fact all objects and could not be considered as ancillary. Leave was granted to appeal to the House of Lords.

Firm claims £10,000 from Board for Overcharging

JUDGEMENT was reserved in the Court of Session action last week in which the British Oxygen Co., Ltd., sued the S.W. Scotland Electricity Board and the B.E.A. for £10,000 in respect of alleged overcharging for the electricity supplied to their Hillington (Glasgow) factory. The company maintain that the tariff imposed by the Board results in undue discrimination. They asked the court to hold that the industrial maximum demand tariff is illegal. In fixing the tariff, they said, the Board exercised undue discrimination against industrial users of suppliers above 6,000 V. It was not an appropriate tariff for supplies to the Hillington works owing to the special circumstances involved. The Board it was alleged, entered into agreement for the supply of electricity at the company's Polmadie works, but although conditions were the same at Hillington, a single agreement was refused. As a result the Board were illegally showing undue preference to other industrial consumers by charging British Oxygen on a monthly basis instead of an annual basis which gave the consumer the option of paying on ten times the maximum monthly demand charge. The £10,000 is the sum which British Oxygen claim they have been overcharged during 1952, 1953 and 1954.

The Board hold that the tariff was fixed validly under the Electricity Act, 1947, and no undue discrimination was shown in fixing it.

Machinery Trades Convention

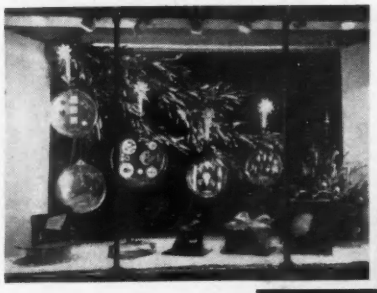
THE Association of Electrical Machinery Trades have announced that their annual Convention in 1955 will take place at Paignton, Devon, from 24 to 26 April. Further details of final arrangements will be issued next month.

Power for Uganda

An excellent pictorial record of the Owen-Falls hydro-electric scheme was shown for the first time last week by the Uganda Electricity Board. "Power for Uganda" was the title of an interesting and well-produced colour film which ran for about 50 minutes. The story of the Owen Falls project was admirably portrayed with a clear and adequate documentary which at no time became overpowering. Sufficient background, covering the country itself and the need for power, whetted the appetite. The film was also notable, especially from an electrical engineer's point of view, because not only was the method of constructing the dam fully dealt with, but there were also some good shots, with appropriate comment and detail, of the plant installed. Some explanatory diagrams added rather than detracted (as they often tend to do) to the interest of this remarkable film.

E.I.B.A. ANNUAL MEETING

IT WAS announced last week that the annual meeting of the N. Metropolitan branch of E.I.B.A. will take place on 12 January (3 p.m.) at Northmet Hse, Southgate, N.14.



Two attractive windows in London which capture the festive spirit are Ediswan's head office display in Charing Cross Rd. (above), and the G.E.C. display at Magnet Hse, Kingsway

High Standard maintained in E.E.B. Display Contest

COMPETITORS in the Eastern Electricity Board's Christmas Service Centre Display Contest will not have to wait until after the festival this year to learn the results. The placings were announced early last week. As has been the practice in the past three years, the Board's showrooms were divided into large, medium and small premises, and the initial judging took place in the sub-areas before the final selection was made. It must be pointed out too that the judges' considerations embraced not only the shop window but also the whole of the display interior.

For the first time in the six annual competitions so far there was a tie for first place; winners in the medium-sized showroom section being Leighton Buzzard and Maldon. Ware emerged in first place among the large showrooms and Harleston among the small centres. Only Maldon, among these four prizewinners have achieved the same distinction before. They gained first place in 1951 when the centres were divided into two groups only. All the Board's service centres entered for the competition, and the judges reported a further improvement in the standard of display which has been true of all five previous contests. The six sub-area winners were Aylesbury (Chilterns); Romford (Essex); St. Neots (Fens); Downham Market (Norfolk); Hitchin (Northmet); and Beccles (Suffolk).

Possibility of U.K. Pavilion at Pakistan Trade Fair

PROVIDED a sufficient number of firms want to take part, a special U.K. pavilion will be erected at the third Pakistan International Industries Fair to be held next year at Karachi. Dates of the exhibition have been given as 5 Mar. to 10 April, but we understand there is a possibility that it will be delayed until the autumn. All classes of industrial and commercial products may be exhibited and special import quotas will be granted to foreign firms taking part. The organiser of the Fair, which is under the patronage of the Pakistan Government, is Mr S. M. Jamil, of Idrees Chambers, 14 Wood St, Karachi.

As regards the British Pavilion, this will be organised by Auger and Turner Group Ltd, Autur Hse, 40 Gerrard St, London, W.1, if, of course, there is the support. There will be about 10,000 sq ft of exhibition space under cover and a further 5,000 sq ft in the open. Charge for space inside (shell stand and normal lighting facilities) will be 35s. per sq ft and outside, 12s. 6d. per sq ft.

BOLTON COLLEGE CONTINUES

FOR some little time now there have been doubts about the future of Bolton's Training College for Technical Teachers. Many readers have expressed their fears that the College was in jeopardy but those fears can be dispelled following the Minister of Education's announcement. The Minister has said that after careful consideration it had been decided that the College should continue and that the necessary capital development should proceed.

STREET LIGHTING

Narrow Streets Provide Problems at Braintree

THE new street lighting installation along main roads through Braintree and Bocking in Essex, was switched on recently at a civic ceremony in Braintree town hall, The scheme is notable because of the tortuous nature of the streets in the town centre and of the wide variety of widths encountered along the carriageway. Some 240 lighting units, supplied by the British Thomson-Houston Co., Ltd., replaced the gas lamps. Road widths varied from 13 ft to 30 ft, an average being 18 ft. In the town centre over 40 lanterns were employed each housing three 5 ft 80 W lamps, and these were wall mounted where streets were particularly narrow. The main radial roads were illuminated by about 200 amber sodium refractor lanterns housing 140 W lamps and mounted on concrete columns. Arm brackets varied in the complete installation from 2 ft to 8 ft in length. Contractors for the scheme were the N. Midlands Engineering Co., Ltd.

Southampton Bridge is Easier Task

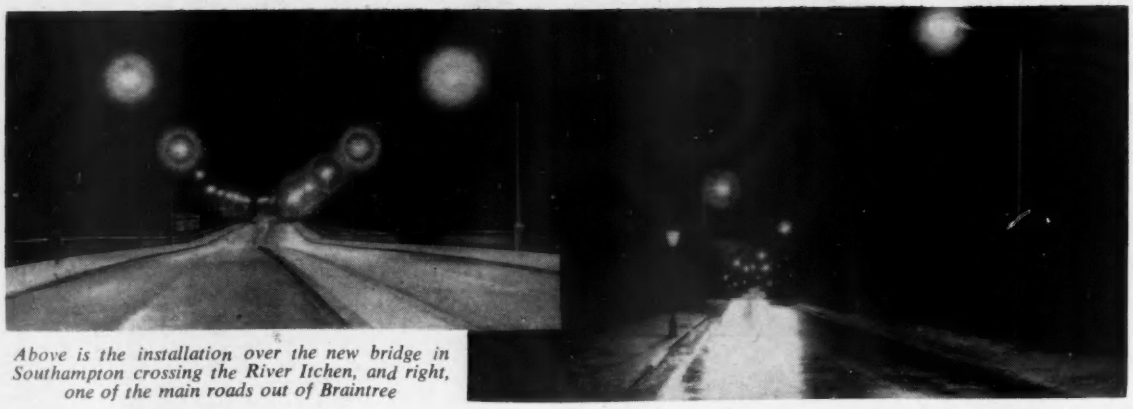
A NEW thoroughfare providing all the traffic facilities which modern road users dream about usually means an easier and pleasanter task for the street lighting engineer. The recently opened bridge across the River Itchen at Southampton supplied just such a situation. Overall length of the five-span concrete bridge is about 2,030 ft and sodium lighting equipment was supplied by the General Electric Co. The columns, however, are of cast iron, zinc sprayed and terminating in flange fittings attached to the parapet. These were made by the Glasgow firm of Macfarlands Ltd. The lanterns each housing a 140 W sodium lamp are mounted on galvanised steel brackets which have a 9½ ft overhang. The scheme was planned by the borough engineer and surveyor, Mr F. L. Wooldridge.

Guide to Street Lighting

AN up-to-date review of current British practice in street lighting is afforded by the publication of a new bulletin by the British Thomson-Houston Co., Ltd.

Amply illustrated with diagrams and tables supplemented by photographs, the new publication will prove most useful to municipal street lighting committees.

In a foreword, the author, H. E. G. Watts, A.M.I.MECH.E., points out that his publication has been prompted by the success of the last (No. 6) bulletin. He stresses that despite the gap in development due to the war years some notable developments, particularly in fluorescent lighting have taken place. The new B.S. Code of Practice for Group "A" lighting introduced has also provided an up to date guide to modern methods. Contents of the bulletin are divided into six chapters covering the *raison d'etre* technical approach, lantern design, quality of equipment, economics and the relevant recommendations, specifications and codes of practice.



Above is the installation over the new bridge in Southampton crossing the River Itchen, and right, one of the main roads out of Braintree

ELECTRICITY SUPPLY IS GOOD BAROMETER OF INDUSTRIAL PROGRESS

THE relationship between the electricity supply and other industries in South Wales was admirably portrayed recently by Mr J. F. Smith, chief commercial officer of the S. Wales Electricity Board in a talk to Cardiff Rotary Club. Electricity he said was an excellent barometer of industrial health and vigour. At present industry in S. Wales was using 80% of the power generated in the area, and there was little doubt that S. Wales was in a very healthy industrial position. He assured his audience there was every confidence that the rapid increase in power needed for industry would be maintained.

Mr Smith gave some figures to support his contention. Since 1948 there had been an increase of 51% in the electricity supplied. Demand had risen from 458,000 kW to 709,000 kW and new generating plant representing 375,000 kW had been installed. Instead of relying on "imports" he said, S. Wales was, for the first time in many years "exporting" power to England via the grid. Of domestic consumption, Mr Smith said an average of only 1,000 units a year was used by domestic consumers. That figure was among the lowest in the country and could easily be doubled. He referred also to the 15 year programme of rural electrification, which was calculated to cost between £10 millions and £15 millions and cater for 85% of farms not yet connected.

Dimplex Ltd., makers of oil-filled radiators known throughout the world, recently opened a London showroom at 17 Shepherd St, Mayfair. The showroom comprises two floors where an effective display of the company's heaters makes yet another brightspot

Report on Success of Scottish Industries Exhibition

A SURPLUS of about £11,000, well over £10 millions worth of business done, and the attendance of some 40,000 trade buyers, briefly summarises the results of the Scottish Industries Exhibition held last September in Glasgow. Mr R. A. Maclean, chairman of the Council of Management, pronounced the exhibition an outstanding success in his report submitted a short time ago. Probably the best indication of an exhibition's success or failure lies in the amount of business done. Exhibitors were asked to make a return of orders and enquiries received, but unfortunately the majority regarded such details as too private to publicise. All that is known definitely is that in one case orders placed reached a figure of £250,000, and in another case from inquiries received orders valued at £500,000 were expected to materialise. Nevertheless, 90% of those participating reported that the exhibition was well worth while and only 3% that it was not. Two of every three firms stated that the exhibition was more valuable than its predecessor in 1949. The amount of business done in 1949 was said to be over £10 millions.

About 40,000 trade buyers visited the show. The majority were of course from the U.K. but there were substantial numbers from overseas as well. Buyers from 41 countries registered, and almost without exception the whole 40,000 spoke highly of the exhibition. Total attendance was nearly 400,000. Inquiries were also made during the exhibition concerning the suitability of the dates chosen and the extent of the show. In both cases about 75% were in agreement with this year's arrangements, when the exhibition ran from 2 to 18 Sept.

It has not yet been decided when the next Scottish Industries Exhibition will be held. It is likely however, that an interval of a few years will be allowed to elapse before the next show is promoted.

Firm in Difficulties Over Export Contract

THE Halifax firm of Arthur Dixon and Co., Ltd., have found themselves in difficulties over an export order to Canada, and, rightly or wrongly, are indignant at the alleged lack of assistance from the Board of Trade and Ministry of Supply. Last September, the firm's managing director, Mr H. S. Campion, with the full support of the B.o.T.'s export dept., visited Canada, and successfully obtained a $30,000 order for small switch assemblies for household meters.

On his return, however, he discovered a shortage in supplies of strip steel, which is on a 8 to 10 month delivery schedule. Prototypes were due to be delivered this month, and consequently the company made frantic appeals to the Government Depts for help, but received little encouragement. Following the large amount of help afforded him by the B.o.T. when he visited Canada, Mr Campion is still hopeful that he will receive the necessary assistance to complete his export order and so uphold national prestige.

In the meantime the company is doing everything possible to honour the contract, even at the risk of incurring a big loss, by adopting unorthodox and expensive methods of manufacture. The satisfactory completion of his order is doubly important because it is a "pilot" order with plenty more business to follow. It was later reported that another company had offered a quantity of strip steel but the price asked was double that normally paid. Efforts on the part of the Leeds office of the Ministry of Supply have also proved unsuccessful.

The First Half-Century

When the Engineering Standards Committee can find time it might try its hand on the Wiring Contractor. He needs standardising badly. In another column will be found a list of thirty tenders for an installation job at Wandsworth. The consulting engineer for the work drew a stringent specification calculated to produce close tendering, yet the prices run down, as steeply and evenly as a flight of steps, from £550 to £282. This all too common phenomenon is probably due not so much to widely varying allowances for profit or materials as to discrepances in the charges for labour, establishment and supervision. When tenders for specified work in any trade display normal variations extending about 100 per cent from the lowest figure, it may be taken for granted that there is something wrong about that particular trade.—*From our issue of 22 Dec.*, 1904.

GLOOM-A VALE

THERE is one small part of England which does not want electric lighting to brighten the district. Residents in part of Maida Vale—London's Little Venice—have protested against the proposed conversion of their gas lights to electricity, because, they say, the substitution would spoil the character of the area. They are asking for the gas lamps to be retained, or failing that, that smaller columns should be used with different lanterns; and, moreover they have the support of the Royal Fine Arts Commission. Paddington Council are adamant, however, that better lighting is required. The only amendment they will concede is that the lamp columns could be darker than usual.

It Cost £20 to Watch Football Match

A SALFORD (Lancs.) man recently decided that if he failed to pay his electricity bill the supply would be cut off and in that way he might succeed in getting rid of his unwanted lodgers. His electricity was cut off, but the landlord wanted to watch a football match on television. Still full of ideas, he climbed into the rafters of the next door house and ran a wire from there to his TV set. That was where his ingenuity failed and in due course he was accused of fraudulently using his neighbour's electricity and was fined £20. The lodgers are still in residence.

More People in the Shrubbery

NEXT year's illuminations at Southend will begin on 20 Aug. and end on 23 Oct. The borough treasurer has reported that last season admissions to the Shrubbery numbered 235,534, compared with 215,018 in 1953. Those visitors were said to have added nearly £765 to the receipts.

NEWS IN BRIEF

An exhibition demonstrating the progress in Britain's atomic power programme is to be held at Thurso next spring. Sir Christopher Hinton, managing director of the industrial group of the U.K. Atomic Energy Authority will visit the town on 4 Jan.

The High Commissioner for Ceylon (Sir Claude Corea) and Lady Corea visited the works of the Brush Group to inspect diesel electric locomotives being made for the Ceylon Government Railway.

Papers presented at the Conference on Welded Structures, held in London in Nov. 1953, and a record of discussions have been published in book form by H.M. Stationery Office, price £2.

Uganda Dept. of African Housing, Kampala, is to hold a Better Homes Exhibition at Ntinda between 21 and 31 May, next year.

Brighton council has resolved that the B.E.P.C. be granted the use of up to 10,000 sq ft of the West St car park for erection of a marquee in connection with the exhibition.

"No shop" was the strict rule adhered to at the annual dinner of Bristol Electric Club. Feature of the event was carol singing.

Fourth edition of the Henley Student Manual has been produced by W. T. Henley's Telegraph Works. This well-illustrated brochure intended for young men entering the organisation, explains the educational and complimentary facilities afforded by the company.

Telcon held their annual dinner at Claridge's on 8 Dec. Guest of honour was Sir Edward Boyle, M.P.

QUESTIONS IN PARLIAMENT

Smokeless Zone Bill

AMONG the Private Members' Bills read a first time last week was one presented by Mr G. Nabarro concerning Smokeless Zones. The Bill seeks to confer powers on local authorities to establish such zones and smoke control areas, and to demand the use of approved types of industrial furnaces and domestic heating appliances. It is due to be read a second time on 4 Feb. and to be printed.

Rating Valuation

A REQUEST that the proposed changes in valuation for rating of domestic, business and industrial premises might be anticipated or at least discussed earlier than the specified April 1956, was made by Mr A. L. Houghton last week. Mr W. F. Deeds said it would be wrong to disclose any forecasts of new assessments until the complete lists were published. Mr Houghton suggested that since the work was completed and assessments were lying ready to be inspected and discussed, some means should be devised of anticipating the publication date. But Mr Deeds replied that there was little likelihood of any existing fears being allayed by publication of the figures suggested.

B.S.I.'s Advisory Council

SOME doubt as to the adequacy of the objects of the British Standards Institution's new Consumers' Advisory Council was expressed by Miss E. Burton in the Commons last Thursday. She asked what the Council intended to do, saying that it appeared they were to offer information and advice, but asking whether it would be better if some action was taken to protect consumers. Mr P. Thorneycroft replied that the Council was set up to give advice on consumer standards to the industrial committees of B.S.I. It was an ordinary piece of machinery set up to give the best possible advice on consumer standards.

H.P. Goods in Press Adverts

A SUGGESTION concerning the definition of hire purchase trading arrangements in Press advertisements was made to the president of the Board of Trade by Miss E. Burton. She drew the Minister's attention to the recommended rules governing advertisements of goods offered on H.P. terms which have been issued to newspapers by the Newspaper Proprietors Association and Newspaper Society. The new rule proposes that every advertisement of that kind should state the cash price of the goods and the total price in H.P. terms; or alternatively the number of payments required. Miss Burton asked if the Hire-Purchase Act could be amended to include such recommendations. The Minister replied that he thought the rule was a good one, but did not consider the matter suitable for legislation.

P.T. on Cathode Ray Tubes

IN a written answer, Mr H. Brooke confirmed that a letter had been received from the British Radio Valve Manufacturers' Association asking that purchase tax be removed from cathode-ray tubes. The Association also asked that the Chancellor should discuss the matter with their representatives and this was being arranged. The question was raised by Mr A. W. Lewis.

Technical College Grants

IN a written answer last week, Sir David Eccles gave the names of 16 colleges in the provinces and eight in London, where courses had been approved for the purpose of advanced technology grant. He was replying to a question by Mr J. Johnson, who also asked how many technical colleges applied for recognition for an increased grant of 75%. Sir David said 90 applied, 63 did not qualify, and three cases are still being considered.

Technological Education

DEVELOPMENT of Glasgow Technical College into a technological university was suggested by Mr A. Woodburn. Rejecting this proposal, Mr J. Stuart said the progress of higher technological education in Glasgow could be served best by a close co-ordination between the college and the university which would not hamper the development of the college. The two institutions, he added, had opened discussions with the object of evolving a scheme satisfactory to both parties, and it was hoped that the talks would have a satisfactory outcome.

Rural Supplies in S.W. Scotland

PROGRESS to date in the rural development of S.W. Scotland was sought by Mr W. Ross. From information supplied by the Area Board, Mr J. Stuart said that at 31 Oct. last, some 2,250 (23%) of farms were still without electricity. During the year ended 31 Mar. an additional 675 farms were connected. The number of connections in the current year would be between 500 and 600, of which about 300 had been completed by the end of October.

Technical Information

AMONG the recommendations contained in the seventh annual report of the Advisory Council on Scientific Policy was one concerning the reorganisation and improvement of scientific libraries and technical information services. Replying

to a question by Sir W. Wakefield, Mr J. R. Bevins said the recommendation was under consideration, but its implementation would involve substantial capital expenditure. He regretted he could say nothing further on the subject at present.

Board Sales of Land

WHEN the B.E.A. or Gas Boards had land to sell, it should be publicly advertised so that the best price was obtained, contended Mr A. R. Hurd last week. He asked if suitable directions could be issued on the matter. Mr L. W. Joynson-Hicks replied that the undertakings always sought the best price possible for land and in all suitable cases advertised publicly.

Commercial TV Wavelengths

In a written answer, Mr D. Gammans gave the wavelengths allocated to the three stations concerned with commercial television transmission, they are as follows:

	Vision (Mc/s)	Sound (Mc/s)
London ...	194·75675	191·27
Lancashire ...	194·75	191·25
Birmingham	189·75	186·25

He said both the London and Lancashire stations will operate on Channel 9 of Band III and Birmingham on Channel 8. The slight difference of 6·75 kc/s for vision and 20 kc/s for sound between London and Lancashire was to guard against possible interference between the two stations.

Employment of Older Workers

REPLYING to Mr E. Johnson last week, Mr H. A. Watkinson said the National Advisory Committee on the Employment of Older Men and Women were to present a further report next year. The committee continued to advise the Minister, and to date many recommendations contained in the first report had been widely accepted by employers, trade unions and the public. Many of the restrictions on the employment of older workers had already been removed, but it was realised there was still a big task ahead.

Sayings OF THE WEEK

"Never before has so much money been spent on machinery—and engineers are the only people who spend money intelligently." . . . MR B. L. METCALFE, president of the association of Mining Electrical and Mechanical Engineers, at Workington.

"The use of a pick and shovel in Canada is about as common as an elephant walking down Grafton Street (Dublin)." . . . MR B. BYRNE speaking at the luncheon of the Dublin Rotary Club.

"It is not without significance that in America 60% of industrial executives began their careers as graduate engineers." . . . PROF E. BRADSHAW, M.B.E., in presenting prizes at Gainsborough College.

ELECTRIC SUPPLY NEWS

Hams Hall

Working in continuous shifts night and day, employees of the Midlands division, B.E.A., have completed a repair job on the No. 6 50 MW turbo-alternator at Hams Hall power station in 3 weeks and 5 hours—which it is claimed as a record for a job of its size. On examination of the after its break-down, it was found that three rows of the turbine blades in the l.p. cylinder had been stripped, and flying metal had caused damage in the next row and minor injuries throughout the 22 expansion stages in the set, it is reported. Fortunately, spare blades were in store, and the next job was to remove the shattered roots of the ruined blades, normally a tedious task. But adopting an ingenious idea of making the turbine into a lathe, and using tungsten-carbide tipped cutting tools, the turbine was revolved on its own shaft and the stumps of the blades quickly cut out. Meanwhile other workmen had tested the remaining turbine blades and repaired minor damage. The immense task of putting in the new blades was finished in a week of 24-hour working and the set was back in commission two days before the target deadline—jolly good show, chaps!

North of Scotland

The first of two 7,500 kW turbo-alternators at the North of Scotland Hydro-Electric Board's new power station at Torr Achilty, in the Conon Valley, Ross-shire, is now undergoing tests and running-in prior to being placed on commercial load. The second machine at the station is in course of erection and should be running before next summer. The Torr Achilty station is part of the Glascarnoch-Luichart-Torr Achilty scheme, the second stage in the hydro-electric development of the Conon Valley. The Luichart power station (24,000 kW) also part of this scheme, was brought into production last September. Another two power stations, Glascarnoch (24,000 kW) and Achanalt (2,000 kW) are under construction.

North Wales

Features of the Ffestiniog pumped storage hydro-electric scheme incorporated in the B.E.A.'s North Wales Hydro-Electric Power Bill (details of which were given in our issue last week) were criticised at a meeting of the joint advisory committee for the Snowdonia National Park. Although agreeing that the new scheme was less objectionable than the earlier proposals, Mr C. J. Tuck, county planning officer, Merionethshire, said he disliked the wide powers the Bill would give the B.E.A. to construct all kinds of ancillary works, and he wanted the length of the exposed pipeline to be much reduced. In the view of Sir Patrick Abercrombie, the Committee's planning consultant, other features needing most careful consideration were the colour of the 90 ft dam on Llyn Stwlan; the power house, which would be the largest building in North Wales; its associated transforming station and the transmission lines on 120 ft pylons taking the current to Denbighshire. He thought there might also be a transmission line passing through the Maentwrog Valley, in which case it should be resisted as it would be "one of the worst things that could possibly happen." He also suggested that a first-rate architect should work in consultation with the landscape consultant. Another speaker was concerned about the extent of the area of mud which might be exposed by fluctuation in water levels, while other members of the committee were more disturbed about the effect of the scheme on the economic life of Blaenau Ffestiniog. It was felt that the slate quarries, already short of labour, might have to close if the more experienced men were offered higher pay by the B.E.A.

Northumberland

The outer sheaths of several 132 kV oil-filled cables at the new Stella North power station were found to be damaged a few days ago. Police were called in to investigate the damage, which, it was said, could have been caused maliciously or accidentally. It was stated that about 400 yards of the underground cable will have to be replaced. Stella North power station is now nearing completion and should be in operation in the near future.

LIGHTING SCHEMES

Ringwood. The Parish Council is seeking consent to borrow £1,353 for providing sodium lighting in the main streets.

Salford. T.C. is submitting to M.o.T. £10,500 scheme for sodium lighting in Cromwell Rd and Great Cheetham St, Broughton, Tootal Drive and Tootal Rd, Weaste, and along Greengate, as well as tungsten lamps round the flats on the B.D.A. site, Liverpool St, and the Trinity clearance area.

Southend-on-Sea. The borough engineer is to prepare further schemes for improved lighting in more main roads in the Borough; £20,000 will be provided in estimates next year to meet the cost.

Southport. Lighting Committee recommends the borrowing of £3,695 for converting lights from gas to electricity in Hawkshead St, Forest Rd, Haig Ave, Talbot St, Hollybrook Rd and Bedford Rd.

Wandsworth. The B.C. is recommended to instal sodium lighting along 56 classified roads and 170 residential roads in Wandsworth, Putney, Clapham and Streatham, at an estimated cost of £168,350.

COMPANY ACTIVITIES

THERE'S no holding the Decca group. Trading balance is up from 1·3 million to an all-time high of £1·7 million. Profits, after tax, have risen from £349,000 to £415,000, and the dividend for the year to March 31 last is 2s. 3d. less tax per share, against 1s. 9d. There is also to be a rights issue of 4s. shares at the price of 10s. in the ratio of one-in-four. There is also to be an issue of 250,000 Unsecured 4½% Notes, and from the premium on the share issue there is to be a 50% share bonus. Latest results still include some E.P.L. Deduct these, and the earnings are equal to nearly 160% on the present capital.

Next time the capital will be just over £1 million, allowing for the new issue and the scrip bonus. On that basis earnings will still be between 80 and 90%. Assuming the dividend is maintained on the capital as increased by the cash issue, the present indicated yield is nearly 5½%, which is generous for a company with such possibilities of further growth.

Results of Marco Refrigerators are out earlier this year. It was the second week in January this year when I congratulated them on their progress towards profitability. This time there is an actual net profit after tax of £1,385 against a net loss of £802 last time. Dividend for the year is 7½%, the first since 1951, and the carry forward is £40,839 against £45,452. The new chairman, Mr E. G. Batt, states that the improved trading results were achieved in a year of increased competition both at home and abroad.

Shareholders may not like some of the remarks made by Mr Ralph Gordon-Smith at the annual meeting of S. Smith and Sons (England). He warned that the company will need to retain substantial profits in the business for capital development, although over the past five years they have spent some £3 million on fixed assets. Capital commitments at the end of the past financial year were £315,000 and there was projected expenditure amounting to over £1 million. Mr Gordon-Smith added that the company's present free cash resources after the forthcoming tax payment were therefore largely ear-marked for future capital expenditure. Although this seems to rule out further bonus possibilities, the fact that the company hopes to pay for extensions without increasing capital, should be excellent from the dividend point of view. I say that advisedly despite the chairman's statement that total group profits may show some reduction in the current year, owing to the policy of not increasing selling prices, and an endeavour to aim for reductions. Against that I would place the possibility of increased turnover because of the price policy, also the fact that the 17½% dividend is covered 4½ times, with E.P.L. taken out of the reckoning.

Terms of the proposed additional capital of Pye Ltd., are now announced. The object is to raise £1½ million of new capital. Stockholders of all classes are to be offered 1 million 5½% £1 cumulative preference shares of 21s. each. Deferred Ordinary and "A" Deferred Ordinary stockholders will have the right to apply for new "A" Deferred Ordinary shares at 22s. 6d. each, in the proportion of one new for every ten 5s. stock units held. With the price of the existing deferred around 35s. the rights should be worth about 1s. a share.—*From our City Correspondent.*

Andhra Valley Power Supply Co.

For the twelve months to 30 June last the profit is Rs.25,82,173 (*Rs.21,89,476*).

Dewhurst and Partner Ltd.

The directors consider that the slight increase in profits is very satisfactory in view of the trading conditions. The strong cash position has been maintained and it is intended to use part of those funds on extensions as soon as a suitable site has been secured. The export business, though difficult, has slightly improved, and Mr M. Dewhurst, the chairman, says he faces the coming years with increasing confidence, particularly as the firm's markets widen with improved and new lines of equipment being manufactured.

Year to 30 Sept.	£ Profit Trading	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	86,806	36,738	111	35	9/10	7/9
1951	117,309	41,264	44	22½*	4/9	3/3
1952	172,735	52,476	55	19	5/4	3/11
1953	169,336	46,806	47	19	6/9	5/–
1954	179,399	74,448	75	24	7/–	5/1

*Plus 200% capital bonus.

Marco Refrigerators Ltd.

The group profit for the year to 30 Sept. last is £4,470 (*£316*) before charging taxation of £3,085 (*£1,118*). The final dividend is 2½%, making a total of 5% for the year, against nil last year.

Oriental Telephone and Electric Co.

Under the arrangements for the acquisition of this company's telephone undertakings in Singapore and Johore Bahru by the Governments of Singapore and of the Federation of Malaya respectively on 1 Jan. next, it has been agreed that the company should receive on account on 31 Dec. 14½ Malayan dollars from the Singapore Government and 500,000 Malayan dollars from the Federation Government. If the final purchase price is substantially higher, further sums on account may be paid.

Parmiter, Hope and Sugden

The board is not to proceed with the Preference capital repayment proposal, to which we referred on 29 July. It is stated that before C.I.C. permission was sought doubts arose about the attitude of the Inland Revenue to the question of a profits tax distribution charge on the repayment. Advice has been received that, because of the scrip issues to Ordinary shareholders in recent years, the repayment would constitute a distribution of profits for the purpose of profits tax, notwithstanding the fact that Preference holders receiving no benefits from such capitalisation. The board therefore considers it in the interest of the company not to proceed; particularly as the burden of tax imposition would fall on the Ordinary shareholder.

Peto Scott Electrical Instruments Ltd.

The directors propose to reduce the capital by writing off 1s. 4d. per 2s. shares and consolidating the balance into 1s. shares. It is also proposed to create 1,200,000 shares of 1s. each.

Plessey Co. Ltd.

Although proud of the company's achievements during the past year, Mr A. G. Clark, the chairman, warns that a disturbing feature of the general industrial situation is that the costs of production continue to rise. The rise may be small each year, but the effect is cumulative, and as compared with the costs of five years ago, the increase is significant. For that reason he is not able to look at future prospects without anxiety.

Year to 30 June	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	284,112	70,058	33	20	19/–	14/3
1951	812,463	214,146	144	22½	22/3	17/–
1952	1,055,096	232,575	158	25	21/–	16/3
1953	1,151,206	304,009	202	30	38/3	20/1
1954	1,382,748	473,484	125	20†	59/9	37/10

*Available for parent company.
†Plus 100% capital bonus.

Tata Hydro-Electric Power Supply Co.

The profit, after taxation and depreciation, for the year to 30 June last, is Rs.22,70,781 (*Rs.20,18,103*).

Tata Power Co.

For the year ended 30 June last, the net profit, after depreciation, is Rs.55,32,025 (*Rs.48,40,113*).

Vactric Ltd.

The directors are applying to the Capital Issues Committee for permission to make scrip issues of one new Ordinary share for each one held, and one new 6% £1 Preference for each four Ordinary. To do this it is proposed to capitalise £300,000 of reserves.

Dividends Declared

Associated British Engineering Ltd. Interim of 4% (*3%*), but the increase does not portend a higher total.

Telephone Rentals Ltd. Interim 4% (*same*), but a larger capital.

Worthington-Simpson Ltd. Interim 10% (*same*) on increased capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

27 Dec.—Renfrew. Installation in R.C. primary school at Port Glasgow.—See 16 Dec. issue.

28 Dec.—Morpeth T.C. Group A sodium vapour lighting units on steel columns along trunk road A.1.—See 2 Dec. issue.

28 Dec.—Pembrokeshire. Installation in infants' schools at Haverfordwest.—See 16 Dec. issue.

29 Dec.—Hertfordshire. Lamps in year from 1 Apr.—See 16 Dec. issue.

29 Dec.—Northumberland. Electrical work in adaptations of air raid sirens.—See 16 Dec. issue.

29 Dec.—Radcliffe T.C. Sodium street lighting units along trunk road A668.—See 9 Dec. issue.

30 Dec.—Belfast T.C. Analytical balance, titration bench and conductivity meter.—Advertised in 9 Dec. issue.

30 Dec.—Co. Kerry. Boiler feed pumps, hot water accelerators and sod breaker at Mental Hospital, Killarney.—See 2 Dec. issue.

30 Dec.—Edinburgh T.C. Rewiring at Portobello swimming pool.—See 9 Dec. issue.

31 Dec.—Belfast T.C. Stores requirements and condenser tubes, tube plate ferrules and packing, and coal conveying plant.—Both advertised in 2 Dec. issue.

31 Dec.—Bredbury and Romiley U.D.C. Sodium street lighting units along Ashton Rd.—See 16 Dec. issue.

31 Dec.—Chippenham T.C. Electrically operated pumping set at Ivyfields station.—See 9 Dec. issue.

31 Dec.—Durham. Installation in five schools, and Bishop Auckland Technical College.—See 16 Dec. issue.

31 Dec.—Failsworth U.D.C. Group B columns, sodium lamps, lanterns, etc., along four streets.—See 16 Dec. issue.

31 Dec.—Grimsby T.C. Installations in special school in Carnforth Crescent.—See 2 Dec. issue.

31 Dec.—Manchester T.C. Multi-core cable for automatic control purposes at Haweswater works, Westmorland.—Advertised in 9 Dec. issue.

31 Dec.—Manchester T.C. Installation at Plant Hill secondary school.—Advertised in 2 Dec. issue.

31 Dec.—Wandsworth B.C. Lamps in year from 1 Apr., and electrical works for three years.—See 25 Nov. issue.

1 Jan.—Lichfield T.C. Electrical fittings in year from 1 Apr.—See 16 Dec. issue.

1 Jan.—New Forest R.D.C. Supply and erection of tungsten lanterns and wooden standards on four estates. Engineer and Surveyor, Council Offices, Lyndhurst. Deposit £1. 1s.

3 Jan.—Chertsey U.D.C. Group A mercury vapour street lighting along Eastworth and Chertsey Rds.—See 9 Dec. issue.

3 Jan.—Finsbury B.C. Supply of electric lamps in year from 1 Apr. Borough Engineer, Finsbury Town Hall Annexe, Rosebery Ave, E.C.1.

3 Jan.—Lancashire. Mobile wireless equipments for Fire Brigade.—See 16 Dec. issue.

3 Jan.—Richmond (Yorks) R.D.C. Ejector plant and pumping plant for Gilling and Aldborough sewerage.—See 2 Dec. issue.

4 Jan.—Gainsborough U.D.C. Supply of submersible pumping set with electrical equipment at Lea Rd Waterworks pumping station. Engineer and Surveyor, Council Offices, 6 Lord St.

4 Jan.—Liverpool T.C. Electrical installation in Birchfield Rd county primary school. City Engineer and Surveyor, Municipal Bldgs, Liverpool 2.

5 Jan.—Macclesfield T.C. Group A, G, and B sodium lighting units on concrete columns.—Advertised in 9 Dec. issue.

6 Jan.—Belfast T.C. Repairs to electrical installation at Strandbourn school meals kitchen in North St. Education Architect, 40 Academy St.

6 Jan.—Belfast T.C. Extensions to low pressure piping installations at Power Station West. — Advertised in 25 Nov. issue.

6 Jan.—Harwich T.C. Installation in flats at Dovercourt.—See 16 Dec. issue.

7 Jan.—Birmingham T.C. Lighting and power and a lift in aged persons' home, Serpentine Rd.—See 16 Dec. issue.

7 Jan.—Sheffield T.C. Installations at colleges of technology and commerce in Pond St.—See 25 Nov. issue.

8 Jan.—Bootle T.C. Supply of electrical goods, cables and lamps during year from 1 Apr. Borough Surveyor, Town Hall.

8 Jan.—Dagenham T.C. Lamps, cables, conduit and accessories in year from 1 Apr.—See 9 Dec. issue.

8 Jan.—Ruislip - Northwood U.D.C. Lamps in year from 1 Apr.—See 2 Dec. issue.

10 Jan.—Sale T.C. Supply and erection of concrete columns, lanterns, mercury discharge lamps, time switches, etc., for class A lighting along 1,350 yd of Northenden Rd and for class B lighting along 200 yd of Green Lane. Borough Engineer's Dept., Town Hall. Deposit £2. 2s.

10 Jan.—West Riding. Rewiring in Harrogate Technical school.—Advertised in 9 Dec. issue.

12 Jan.—Dublin. Three electric goods lifts for Port and Docks Board.—See 9 Dec. issue.

12 Jan.—Dublin. Three overhead travelling electric gantry cranes.—See 2 Dec. issue.

12 Jan.—Scunthorpe T.C. Supply of concrete columns, mercury discharge lanterns, etc., and erection and wiring of 66 columns. C. Cooper, Borough Surveyor, Comforts Ave. Deposit £2. 2s.—Advertised in this issue.

14 Jan.—Carlisle T.C. Electrical installation in 100 houses. City Engineer, 18 Fisher St.

16 Jan.—Whiston (Lancs) P.C. Sodium vapour discharge lighting units on Liverpool-Warrington trunk road.—Advertised in 16 Dec. issue.

17 Jan.—Exeter T.C. Vertical spindle electric pump at Countess Wear sewage works.—See 9 Dec. issue.

17 Jan.—Marlborough (Wilts.) R.D.C. Supply of two sets of electrically-driven vertical unchokeable sewage pumps and ancillary equipment for Aldbourne drainage scheme. John Taylor and Sons, Artillery Hse, Artillery Row, Victoria St, Westminster. Deposit £5.

17 Jan.—Newbury T.C. Supply and erection of steel columns and lighting equipment for scheme along Oxford Rd. (A.34). Borough Surveyor, Municipal Buildings.—Advertised in this issue.

18 Jan.—Ilfracombe U.D.C. Concrete columns with fluorescent and sodium lanterns, etc.—Advertised in 16 Dec. issue.

18 Jan.—Penybont R.D.C. Electrical installation (including 1,244 points) in 468 houses. Surveyor, Penybont Offices, Coity Rd, Bridgend. Deposit £2. 2s.

19 Jan.—Fareham U.D.C. Fittings and lamps in year from 1 Apl.—See 16 Dec. issue.

21 Jan.—Dundalk U.D.C. Two pumping units with accessories for water supply augmentation scheme.—See 2 Dec. issue.

24 Jan.—Lanarkshire. Installation in fire station at Lanark.—See 16 Dec. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 131 queries answered this week

Element marked "Walkers" and W. H. and Co., Ltd., Falkirk, makers of? W.C.L.—Walker, Hunter and Co., Ltd., Pordownie Iron Works, Camelon, Falkirk.

2 amp, 3 pin, shuttered socket outlets, makers of? J.L.—Walsall Conduits Ltd., North End Rd, W.14, list one.

"Necchi" sewing machines, address for? L.E.B.—Necchi Ltd., 1 Old Burlington St, W.1.

"Renat" lighting fittings, makers of? W.E.L.—New Endeavour Eng. Ltd., 4 Avenue Rd, N.W.10.

"Buvan" ultra-violet ray air steriliser, makers of? W.E.B.—Barber Electrical Services Ltd., Bournville, Birmingham 30.

"Popular" vacuum cleaners, makers of? K.W.—Household Machines Ltd., Salisbury Hse, London Wall, E.C.2; Co-operative Wholesale Society Ltd., Balloon St, Manchester; and Phoenix Telephones and Electric Works Ltd., Edgware Rd, N.W.9, have supplied vacuum cleaners under this title.

"Vi-Tan" ultra-violet lamps, makers of? L.E.B.—Thermal Syndicate Ltd., Vitrosil Works, Wallsend-on-Tyne.

"Octopus" armature testing equipment, makers of? T.E.—Armature Mfg. Co., Rushbank Electrical Works, Burnley St, Oldham.

24 Jan.—Newcastle-on-Tyne. Electric cargo-grabbing cranes at Albert Edward Dock.—See 2 Dec. issue.

25 Jan.—Flint T.C. Electrical installation in 17 dwellings on Castle Ward site. Borough Engineer and Surveyor, Municipal Offices, Earl St. Deposit £1.—Advertised in this issue.

29 Jan.—Bedlington (Northumb) U.D.C. Supply of electrical goods during year from 1 Apr. A. K. Dennis, Engineer and Surveyor, Council Offices.

29 Jan.—Prestwich T.C. Electrical equipment and lamps required during year from 1 Apr. Borough Engineer, Town Hall.

29 Jan.—Co. Louth. Supply and erection of electrically operated pumping units, 10,000 g.h.p. capacity for Ardee water supply. Consulting engineers, P. H. McCarthy and Sons, 26 Lr Leeson St, Dublin. Deposit £10. 10s.

31 Jan.—Antrim R.D.C. Sewage pumps, with control gear, heating and lighting. —See 16 Dec. issue.

No date stated.—Aberyswyth. Installation at Aberayon and Tregaron Chest Hospitals.—See 16 Dec. issue.

No date stated.—Crawley (Sussex) P.C. Concrete columns and fluorescent lanterns.—Advertised in 16 Dec. issue.

No date stated.—Merthyr Tydfil. Installations in hospitals under Merthyr and Aberdare Hospital Management Committee.—See 16 Dec. issue.

No date stated.—Somerset. Heavy duty cooking equipment.—See 16 Dec. issue.

No date stated.—Hertfordshire. Applications invited for inclusion on approved list of contractors for electrical work. Clerk of County Council, County Hall.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

20 Jan.—South Africa. Stores and Buying Branch of City of Johannesburg, invite tenders (No. 484) for supply of 20 kV cable, pilot and telephone cable and accessories. B.o.T. (Ref.: ESB 28704/54).*

21 Jan.—South Africa. Supply of 500 fuse carriers and 1,250 fuse cartridges to various specifications for City of Durban. B.o.T. (Ref.: ESB 28659/54).*

27 Jan.—New Zealand. Tenders (No. 413) invited for 55½ miles textile covered core lead sheathed telephone cable for N.Z. Post Office, 49 Willis St, Wellington. B.o.T. (Ref.: E.S.B. 28921/54).*

31 Jan.—Iraq. Supply and erection of diesel electric generating sets 100 kW a.c. 400/230 V, 3-phase 50 c/s at Mendeli, Abu Sukhair, Hamza, Faisaliya and Balad. At Balad two 100 kW sets and a 50 kW set are required. Tender documents numbered 54, 53, 50, 52 and 48 resp. Directorate General of Municipalities, Baghdad. B.o.T. (Refs: ESB 28759/54, 28739/54, 28758/54, 28736/54, 28738/54, resp).* All are separate contracts.

1 Feb.—U.S.A. Supply of main unit auxiliary switchgear units F 1 to 8 for Dalles Dam powerhouse. District Engineers, Corps of Engineers U.S. Army, 628 Pittock Block, Portland, Oregon. B.o.T. (Ref.: ESB 28863/54).*

7 Feb.—Australia. Supply of 3 electrically driven boiler feed pumps and valve equipment for Western Australian Govt. Documents may be had from Agent General for W. Australia, Savoy Hse, Strand, London, W.C.2, to whom bids may be sent by above date. B.ds sent to W. Australian Govt. Tender Board in Perth should arrive by 17 Feb. B.o.T. (Ref.: ESB 28503/54).*

7 Feb.—Australia. Manufacture, erection, etc., of 4–45 MVA 132 kV transformers for Bunnerong power station for Electricity Commission of N.S.W. Kelvin Hse, 15 Castleragh St, Sydney. B.o.T. (Ref.: ESB 29087/54).*

8 Feb.—New Zealand. Tenders (P and T 150/7591) invited for supply of six constant output voltage type transformers, input 190-250 V, output 230 V, single-phase, c.c., 50 c/s. Stores Div., G.P.O., Windsor Bldg, 49 Willis St, Wellington. B.o.T. (Ref.: ESB 28277/54).*

11 Feb.—Australia. Supply of twelve 33 kV 3-phase outdoor type oil circuit-breakers, rupturing capacity 1,000 MVA with current transformers, trip coil, operating mechanism etc. Brisbane City Council, City Hall, Brisbane. Tender No. E.45/54 B.o.T. (Ref.: ESB 28804/54).*

16 Feb.—India. Supply and erection at Periyar Power station of power transformers and outdoor switchgear. Tenders (E.199) invited by Govt. of Madras, Electricity Dept, 157 Mount Rd, Madras. B.o.T. (Ref: ESB 28180/54).*

22 Feb.—India. Construction of about 241 miles of 110 kV and 53 of 66 kV transmission lines under Periyar Hydro-Electric Scheme. Tender No. E.249. Dept. of Electricity, Govt. of Madras, 157 Mount Rd, Madras. B.o.T. (Ref.: ESB 28762/54).*

22 Feb.—India. Supply of electronic valve making machines and equipment. Documents from Director-General, India Store Dept., Govt. Building, Bromyard Ave., Acton, London, W.3, at 10s. Quote ref.: S.1728/54/27/CIV.3.

1 Mar.—New Zealand. Supply of two on load tapechanging naturally cooled 15 MVA 3-phase transformers for Electricity Dept. of Dunedin City Corpn. B.o.T. (Ref.: ESB 28504/54).*

22 Mar.—New Zealand. Electricity Dept. of Dunedin City Corpn. invite tenders for supply of one 6·6 kV switchboard comprising 16 circuit-breakers. B.o.T. (Ref.: ESB 28631/54).*

5 Apr.—Brazil. Supply of insulated and bare electric cables, insulators, steel pylons, fittings and accessories for 138 kV transmission lines of Jacui hydro-electric power station, Rio Grande do Sul. Specifications from Turma de Comunicacoes e Arquivos, Comissao Estadu al de Energia Eletrica, Edificio Nova da Prefeitura, 11. andar, Porto Alegre. B.o.T. (Ref.: ESB 28818/54).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Monday, 20 December

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	282½	+5½	231½
„ (3 months)	268½	+3	220
LEAD, refined pig, min. 99·97% purity (cash)	103½	—	90
„ (3 months)	102½	−½	88½
TIN, refined, min. 99·75% purity (settlement)	692½	−21½	650
„ (3 months)	693½	−19½	627½
ALUMINIUM, ingots 99-99·5%	156	—	150
ZINC, virgin, min. 98% purity (cash)	82½	−1½	75½
„ (3 months)	82	−1	74½
RUBBER No. 1, RSS, spot (per lb.)	26½d.	+1⅛d.	17½d.
„ c.i.f. basis, ports, Feb. (per lb.)	25⅛d.	+1½d.	17d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	51½
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

Chelmsford T.C. Alteration and provision of additional street lighting, Cohen Bros. (Electrical), Ltd., £5,767.

Dagenham T.C. Conversion of gas lighting to electricity along a number of roads, Eastern Electricity Board, £8,639.

Glasgow T.C. Electrical work at Drumchapel primary school, Claud Hamilton Ltd., £1,970.

Haverfordwest T.C. Street lighting on Prospect Place estate and along various roads, S. Wales Electricity Board, £1,488.

Leeds T.C. Supply of 300 group B sodium lanterns, British Thomson-Houston Co., Ltd., £3,846.

Llandudno U.D.C. Supply, erection, wiring, etc., of concrete columns with lanterns involving some 158 points, General Electric Co., £3,655.

Newcastle-on-Tyne T.C. Renewal of power supply cables for quayside cranes, Scottish Cables Ltd., £1,930.

Oxford T.C. Wiring of power house at sewage disposal works, Southern Electricity Board, £1,209.

Peterborough T.C. Installation of 70 houses in Walton estate, General Electric Co., £1,538; and in 68 houses on same site, M. F. Hansen and Co., £1,486.

Preston T.C. Electrical installation at Eldon St county primary school, R. A. Ranson, £1,272.

Todmorden T.C. Extension of sodium lighting along trunk road, N. Midlands Engineering Co., Ltd., and Revo Electric Co., Ltd.

Walthamstow T.C. Installation at The Drive, Woodford Electrical Co., £1,329.

Woolwich B.C. Installations on Bostall Hill site, London Electricity Board, £1,014.

Following contracts have recently been awarded to J. B. Saunders, Ltd., Cardiff: Installation at **Swansea** fire station, £4,636; Installation at Tyntyla Hospital, **Rhondda**, £2,555; Installation in council offices at **Caerphilly**, £657.

TRADE NOTES

New Branch. Superlamp Ltd. are opening on 3 Jan. next, a new branch and trade counter at 102 Kingsland Rd, London, E.2. Telephone: Shoreditch 6061.

New Year Holiday. The East Pilton works of Bruce Peebles and Co., Ltd., will be closed from 31 Dec. until 6 Jan.

Another Factory. Thorn Electrical Industries Ltd. are to take over a vacant factory on the Pallion trading estate, Sunderland.

BUSINESS PROSPECTS

Home

Airdrie. Approval granted for erection of police headquarters in Anderson St at cost of about £56,000.

Ashington. Work on additions to hospital, planned by Newcastle Hospital Board, expected to start in spring.

Barking T.C. Erection of 4-storey block of shops with flats in London Rd/North St development. Also of Thames View county infants' school. Borough Architect, Town Hall.

Bethnal Green. Scheme approved for erection of total of 206 flats in a number of large blocks on Hereford St site. Total estimated cost of project is £592,370.

Birkenhead T.C. Plans approved for construction of further 198 houses and 60 flats at Woodchurch. It is also proposed to erect another 528 of a total of 743 houses on the same site during 1955. Also, St Peter's Church is to be rebuilt.

Birmingham. B.S.A. Co., Ltd., planning a research station at Mackadown. Architects are Hobbiss and Hobbiss, 36 Waterloo St.

Bristol. It is proposed to build 7-storey building, including cinema, departmental stores, shops, offices, etc., for Jacey Investments Co. Ltd. Architects are W. H. Watkins, Gray and Partners, 1 Clare St. Estimated cost £1 million.

Bushey (Herts). It is proposed to erect secondary modern school at Cold Harbour at estimated cost of £160,047.

Castle Douglas T.C. Scheme approved for £1,100 extensions to town hall.

Chelmsford. Approval received for extensions to Mid-Essex Technical College and School of Art. They are estimated to cost £173,000.

Cheltenham T.C. Plans to be prepared for extensions to municipal offices.

Cheshunt (Herts). Major extensions proposed at county grammar school are estimated to cost £52,425.

Co. Down. Construction of intermediate school at Glastry, Kircubbin. Quantity surveyor. Roe Stevenson and Sons, 33 College Gardens, Belfast.

Cornwall. National Farmers Union's Cornwall branch preparing scheme for erection of factory at Doublebois. Estimated cost £400,000. Branch is at 6 Strangeways Terrace, Truro.

Coventry. Application to be made to borrow £179,600 for erection of Alderman Green infants' school and final instalment of Woodlands secondary (comprehensive) school.

Croydon. Approval received for second stage of technical college at Fairfield. Cost estimated at £300,000.

Darlaston U.D.C. Construction of 50 houses on Bentley estate. G. R. Rowlands, Clerk of Council, Town Hall.

Dublin T.C. Erection of four blocks of flats, comprising 70 dwellings in Vicar St. City Treasurer, Exchange Bldgs, Lord Edward St.

Dundee. Plans approved for two-storey building in St Andrew's St for G. Maclean and Co. Ltd., Ward Rd. Scheme for £60,000 extensions for Hardie and Smith Ltd., Baillie Works, Annfield St, has also been approved.

Dundee. Scottish Special Housing Assoc. are to erect additional 262 houses on Mains of Fintory estate.

East Kilbride. Development Corpn. to build factory offices etc. on Norsten industrial estate. Architect is Frank Scott, Torrence Hse.

Edinburgh. Dean of Guild Court has granted warrant to Esso Petroleum Co., Ltd., to build petrol storage installation at Leith docks costing some £100,000.

Gateshead T.C. Plans approved by Housing Committee for construction of eleven 8-storey blocks comprising 495 flats on three sites at Wrekenton. Estimated cost is £958,162.

Glasgow T.C. It is proposed to carry out electrical installation in garage at Polmadie Depot at estimated cost of £7,800.

Grantham. Improvements and additions to various school kitchens and canteens proposed by Kesteven C.C. are estimated to cost £9,300.

Greenwich. Revised scheme in hand for construction of 148 flats and 150 houses, as well as other dwellings on Brooklands Park estate. Estimated cost, £670,310.

Halesowen T.C. Erection of 22 houses on Fatherless Barn estate. Also erection of 52 on Hasbury Farm estate. A. T. Butler and Partners, architects and surveyors, 31 Priory St, Dudley.

Hartlepool T.C. Tenders to be invited for erection of 80 houses off King Oswy Drive. Borough Engineer, Municipal Buildings.

Leicester T.C. New Overdale junior school is estimated to cost £78,485.

Liverpool. Land on Aintree industrial estate will probably be leased to James Brown and Co., 33 Parr St, for erection of factory.

London. Locomotive Manufacturers' Association proposing to erect offices in Buckingham Gate. Plans by A. E. Stone Toms & Partners, 28 South Audley St, W.1.

Maidenhead T.C. Construction of 44 houses on Spencers estate. Borough Engineer and Surveyor, 14 Cranfurd Rise.

March. Isle of Ely C.C. propose to improve kitchen facilities at Hereward school.

Market Harborough U.D.C. It is proposed to build 16 dwellings in Bath St, 12 bungalows in Shropshire Place, 10 houses in Lentham Sq, and 3 shops with flats in Western Ave.

Middlesbrough. Ear, nose and throat outpatient's dept. to be established at North Riding Infirmary in Newport Rd.

Morpeth (Northumb.) R.D.C. About 630 houses are planned for construction in next four years. Also, a further 50 houses to be built at Brownhill. J. R. Miles, surveyor, Dacre St.

N. Ireland. C. Lord Ltd. propose to build factory at Donaghadee. Architect is H. Lynn, 110 Scottish Provident Buildings, Belfast.

Northumberland. Construction of fire station at Bellingham. C. C. Brown, County Arch., County Hall, Newcastle.

Peterborough T.C. Total of 326 houses to be built on various sites during 1955.

St Albans (Herts) U.D.C. Tenders to be invited for erection of about 50 houses at Redbourn.

Sheringham U.D.C. Concert hall to be built in Cromer Rd at estimated cost of £12,000.

Skegness U.D.C. Approval granted for erection of conference hall. Cost estimated at £200,000.

Southport (Lancs). Work expected to begin next April on new R.C. church at Birkdale. Architect is L. Pritchard, of Bootle.

Stirling. Erection of junior secondary school at Bannockburn. James Gentles and Sons, chart. quantity surveyors, 3 Hill St, Edinburgh.

Stockton-on-Tees T.C. Secondary modern school costing £112,000 proposed for Roseworth site. Work expected to start next year.

Sunderland T.C. Erection of primary junior school on Hylton Castle estate. Borough Architect, H. C. Bishop, Grange Hse, Stockton Rd.

Sussex. Approval given for erection of secondary schools at Littlehampton and Horsham. Costs estimated at £165,834 and £164,904 resp.

Swindon. It is suggested that new factory costing about £37,000 should be built on the industrial estate. Selected contractors may be asked to tender for erection of another factory on same estate which is estimated to cost £85,000.

Tynemouth. Hadrian Supply Co., Ltd., are to equip land at West Chirton for factory, warehouse and printing dept.

Wandsworth B.C. Construction of 22 houses in Portinscale Rd and block of flats in Fairfield St. Borough Engineer and Architect, Municipal Bldgs, S.W.18.

Whitby U.D.C. Architect to prepare plans for 90 houses and 16 bungalows on section of the White Leys estate.

Overseas

Ceylon. Hentleys Ltd., P.O. Box 670, Mackinnon Building, York St, Colombo, want to obtain agency of U.K. manufacturer of radio sets, not already represented in Ceylon. They want 3-valve, dry battery operated, long and medium wave sets.

New Guinea. Direct representation for Papua and New Guinea of U.K. manufacturers of domestic electrical goods, sought by Global Agencies (New Guinea) Ltd, of Wyatt's Bldgs, Hunter St, (Box 127 G.P.O.), Port Moresby, Papua.

Gazette Announcements

COMPANIES ACTS

Davis Myer and Co., Ltd. Liquidator, Bernard Phillips, 76 New Cavendish St, London W.1, released from 3 Sept.

J. S. Engineering Co., Ltd. Leslie Stewart Findlay, the liquidator, 4 Charterhouse Sq, London E.C.1, released from 15 Nov.

Modern Electric Power Products Ltd. John M. Clarke, Sen. Official Receiver, of Inveresk Hse, 346 Strand, W.C.2, company's liquidator released from 4 Dec.

BANKRUPTCY ACTS

Public Examinations

Derby. Charles T. Boden trading as High Peak Wholesale Electrical Supplies at 5 Hartington St, Derby. Public exam will be at Court Hse, 20 St Peter's Church Yard, Derby, on 15 Mar. at 10 a.m. First meeting was on Tues. (21 Dec.).

Salford. John G. Barrett, trading at 134 Broad St, Pendleton, as Barrett's Electrical Installations. Examination will take place on 22 Feb. at Court Hse, Encambe Place, Salford, at 2 p.m. First meeting was on 21 Dec.

Gloucester. Desmond A. Trotman, electrical engineer trading at Salter St, Berkeley. First meeting takes place today (23 Dec.) at Official Receiver's Office, 26 Baldwin St, Bristol, at 11 a.m. Public examination at Shire Hall, Gloucester, on 23 Feb. at 2.30 p.m. Receiving order dated 8 Dec.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

A. Parsons (Electrical Fittings) Ltd. 5 and 6b Wellington St, Brighton. Nom. cap.: £500. Dirs.: A. Parsons and Mrs C. E. Parsons.

Symphony Amplifiers Ltd. 42 Tottenham St, W.1. Manufacturers of and dealers in electrical goods, wireless and television sets, etc. Nom. cap.: £500. Dirs.: D. Dumville and H. C. Reynolds.

I.S.T. Insulations Ltd. Electron Works, Brook St, Preston. To acquire and hold shares, stocks, debentures, etc. Manufacturers of and dealers in electrical insulating materials, electrical instruments, etc. Nom. cap.: £100. Dirs.: J. N. Bullivant, K. R. Wilcox and E. L. Hoyle.

British Pleuger Submersible Pumps Ltd., Station Rd, Coleshill, nr. Birmingham. Electrical, hydraulic and marine engineers, manufacturers of and dealers in electrical pumps and switchgear, etc. Nom. cap.: £10,000. Dirs.: L. Meredith, W. Frost and F. W. Pleuger.

L. A. Stockwell and Sons Ltd. 11 Manor Corner, Manor Rd, Paignton. Manufacturers of and dealers in electrical goods, wireless and television sets, etc. Nom. cap.: £1,000. Dirs.: L. A. Stockwell and Muriel D. Stockwell.

Electrothanators Ltd. Manufacturers of and dealers in scientific equipment, etc. Nom. cap.: £1,000. Dirs.: W. F. Talbot and S. J. S. Eley, 1 Broad St Place, E.C.2.

A. E. Greaves and Son, Ltd. 1 Marygate Chambers, Wakefield. Heating, ventilating, refrigeration, lighting, insulation and general engineers and consultants, etc. Nom. cap: £5,000. Dirs.: A. E. Greaves and B. H. Greaves.

Boreham (T.V. Sales) Ltd. 8 Havelock Rd, Civic Centre, Southampton. Manufacturers and repairers and hirers of and dealers in electrical and mechanical apparatus and accessories, in particular wireless and television, etc. Nom. cap.: £500. Dirs.: A. S. Wilson and P. J. Boreham.

L.B. Products and Engineering Ltd., 32 Sussex Rd, Petersfield, Hants. Mechanical, electrical, wireless, motor, aeronautical, atomic, plastic and general engineers, manufacturers of fire fighting appliances, etc. Nom. cap.: £500. Dirs.: L. M. J. Balfour and Mrs E. M. Balfour.

Donald R. Weir Ltd., 139 Wickham Ave, North Cheam, Surrey. Electrical engineers and contractors, dealers in electrical apparatus, radio and television apparatus, etc. Nom. cap.: £1,000. Permanent director: D. R. Weir.

Thornton and District Electric Co., Ltd., 62 Fleetwood Rd, Thornton-le-Fylde, Lancs. To take over business of radio and electrical engineers carried on at Thornton-le-Fylde, Lancs, by Leslie S. Wetherley and John R. Reid. Nom. cap.: £3,000. Dirs.: L. S. Wetherley and J. R. Reid.

David Howard Ltd., 22 Upper Grosvenor St, W.1. Manufacturers of and dealers in television and wireless sets, radiograms, refrigerators, etc. Nom. cap.: £2,000. Dirs.: H. I. Cooper and T. Radzan.

Applied Research Laboratories (Great Britain) Ltd. To manufacture and deal in scientific instruments, instruments used in industry and elsewhere for calculating and computation and for analysis by any means of materials, and instruments for measurement of tensile strength and hardness, etc. Nom. cap.: £10,000. Dirs.: to be appointed by subs. Subs.: Hazel K. Hebben and Constance M. Langrish, 6 Austin Friars, E.C.2.

Sanderson (Mechanisation and Development) Ltd. 15 Arlington Drive, Ruislip, Mddx. Research and development engineers, and electrical engineers; to undertake scientific research and develop apparatus and manufacturing processes in connection therewith; to undertake processing and fabricating of all metals, plastics and timber, etc. Nom. cap.: £1,500. Dirs.: T. E. F. Sanderson and Ena M. Sanderson.

Wentworth Electronics Co., Ltd., 8 Station Approach, Wentworth, Virginia Water, Surrey. Wireless, electrical, television, public address and recording engineers, etc. Nom. cap.: £100. Dir.: I. A. B. Brampton.

Douglas E. Wright Ltd. Empire Hse, St. Martins-le-Grand, E.C.1. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £100. Dir.: D. E. Wright.

Spencer and Hill Ltd. 34 North St, Bingley, Yorks. Electrical and electronic engineers, etc. Nom. cap.: £1,000. Dirs.: W. A. Spencer and F. B. Hill.

Paton (Balham) Ltd. 10 Yukon Rd, Balham, S.W.12. Electrical engineers and contractors, etc. Nom. cap.: £100. Dirs.: L. A. Hastilow, Mrs I. M. Hastilow and N. Paton.

Rekoob Ltd. Manufacturers of and dealers in gramophone, radio, wireless, television and electrical components, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: G. J. Boyles and A. W. Paterson, 1 Threadneedle St, E.C.2.

Turbomachines Ltd. George St Chambers, Staines, Middx. General, consulting and mechanical engineers, specialists in turbines, compressors, pumps, etc. Nom. cap.: £100. Permanent dirs.: J. C. Barr and J. C. Grey.

Kershaw Heating Ltd., 72a Ainsworth St, Cambridge. Heating and ventilating engineers, etc. Nom. cap.: £2,000. Dirs.: J. H. Kershaw, K. C. Kerridge, S. H. Jones, C. F. Holland and P. B. Kerridge.

Edward Ward and Co., Ltd. 10 Bridgeway Hse, Hammersmith Bridge Rd, W.6. Manufacturers' agents for diesel, petrol and electrical engines and motors, generating plant, etc. Nom. cap.: £5,000. Dirs.: W. E. Ward, D. H. Strathern, E. Sparkes and R Sparkes.

H. W. Berwick Ltd. Victoria Bldgs, The Bridge, Walsall. To take over business of manufacturer and retailer of radio and television receivers and wireless and electrical engineer carried on as "Phonart" by Herbert W. Berwick. Nom. cap.: £5,000. Dirs.: H. W. Berwick and Mrs J. Wilkinson.

Photo Printed Circuits Ltd. Ellerman Hse, 19-21 Moorgate, E.C.2. To enter into agreement with Norton and Gregory Ltd., and Fredk. C. Mitchell, to acquire, develop and turn to account process and improvements comprised therein; manufacturers of and dealers in electrical, electronic, radio, television and radar equipment, etc. Nom. cap.: £5,000. Dirs.: not named. Subs.: E. Chester, 1-2 Castle Lane, Buckingham Gate, S.W.1; and F. C. Mitchell, 5 Compton Ct, Benhill Wood Rd, Sutton, Surrey.

Phillips Bros. (Electrical Engineers) Ltd., 154 Wheeler St, Lozells, Birmingham 19. Nom. cap.: £5,000. Dirs.: P. E. Phillips, J. E. Phillips, and F. J. Phillips.

Refrigeration and Electrical (Sussex) Ltd., 5 Bartholomews, Brighton 1. Nom. cap.: £1,000. Dirs.: G. H. Christmas, D. S. E. Herrtage, and K. G. Christmas.

G. J. Wade and Son Ltd. 28a Widmore Rd, Bromley, Kent. Electrical contractors, wholesalers, distributors and importers of and dealers in electrical goods, wireless and television sets, etc. Nom. cap.: £10,000. Dirs.: W. J. Wade and Mary J. Wade, J. G. Knight and Gwendoline M. Knight.

MEETINGS TO NOTE

WEDNESDAY, 29 DEC.

COMMERCIAL TRAVELLERS' BENEVOLENT ASSOC. Annual Court of Governors at Berners Hotel, Berners St, W.1, 12 noon.

BRIT. INSTN. OF RADIO ENGRS. (London). Discussion on "Education and Training of Radio Engineers," School of Hygiene, Keppel St, W.C.1, 6.30 p.m.

THURSDAY, 30 DEC.

I.E.S. (Birmingham). Display of New Lighting Fittings at College of Technology, Suffolk St.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Magnite. 728,253. Class 17. Steel in sheet or strip form having an electrical insulation surface. Steel Co. of Wales Ltd., Newport Division, Orb Works, Newport, Mon.

Commodore. 734,486. Class 9. Vacuum cleaning apparatus. Neptric Ltd, 73/79 Hurst St, Birmingham 5.

Duvee. 734,716. Class 9. Wireless aerials. Belling and Lee Ltd, Gt Cambridge Rd, Enfield, Middx.

Pneumotron. 730,538. Class 10. Electrically controlled lung inflating apparatus. British Oxygen Co., Ltd., Bridgewater Hse, Cleveland Row, St James's, S.W.1.

G.D.H. Product in design. 731,161. Class 10. Lamps for surgical and curative purposes. G. D. Harrison and Sons, Ltd., 55 Northgate, Huddersfield.

Isolube. 724,591. Class 4. Oils for use on electrical contacts. Gulf Oil (Gt Britain) Ltd., 5 London Wall Buildings, Finsbury Circus, E.C.2.

Chemix. B673,113. Class 7. Crystallising, drying, mixing machines, machines for coating electrical apparatus and wire with insulating media, etc. F. and R. M. Harris (Birmingham) Ltd., 17/18 Doe St, Birmingham 4.

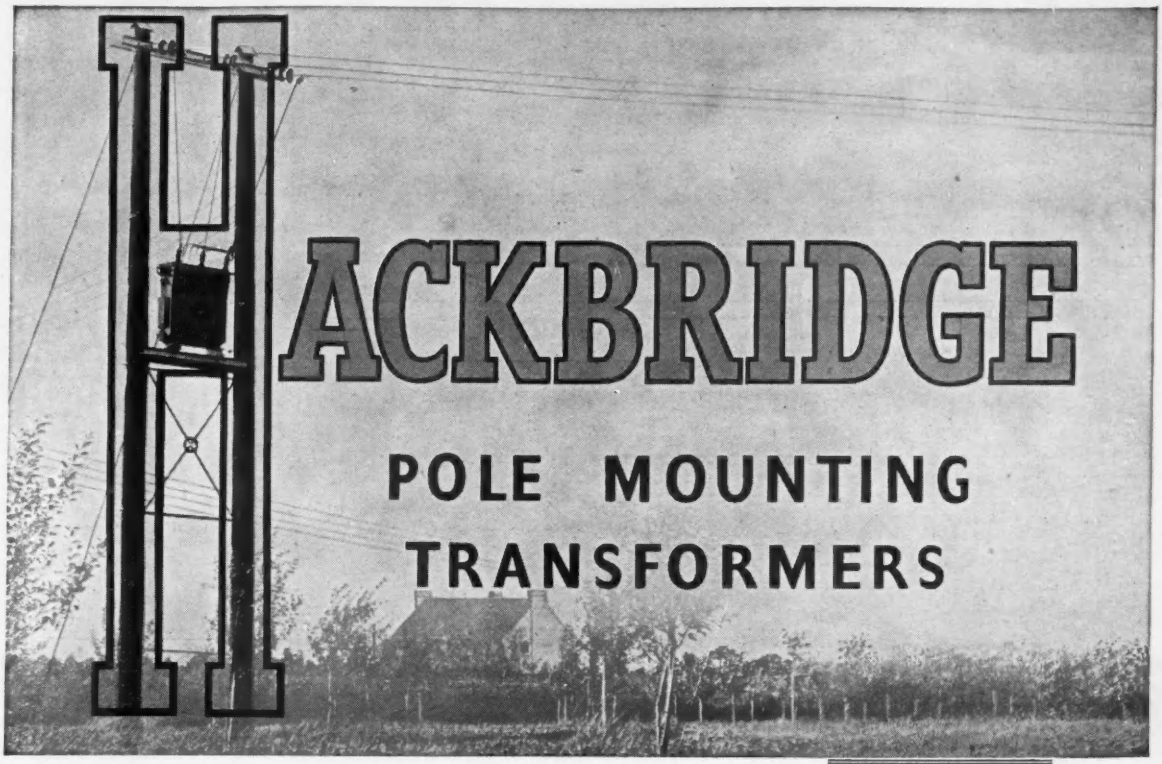
Teddington Automatic Controls in design. B713,488. Class 9. Thermostatic valves, thermostats magnetic and motorised valves, etc. British Thermostat Co., Ltd., Windmill Rd, Sunbury-on-Thames.

Castubes. 731,671. Class 9. Capacitors. Plessey Co., Ltd., 56 Vicarage Lane, Ilford, Essex.

Stabilformer. 733,144. Class 9. Electrical indicating and measuring apparatus and instruments, etc. B.P.L. (Instruments) Ltd., Houseboat Works, Watling St, Radlett, Herts.

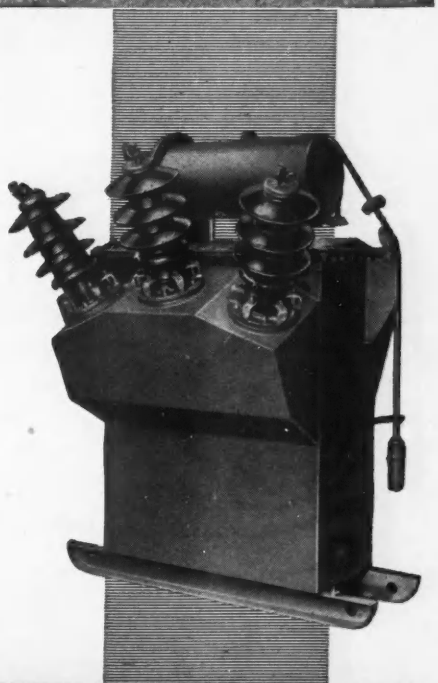
Cuecaps. 733,922. Class 9. Capacitors. A. H. Hunt (Capacitors) Ltd., Bendon Valley, Garrett Lane, S.W.18.

Unitag. B729,467. Class 17. Insulation parts of electrical instruments. McMurdo Instrument Co., Ltd., 10 Upper Berkeley St, W.1.



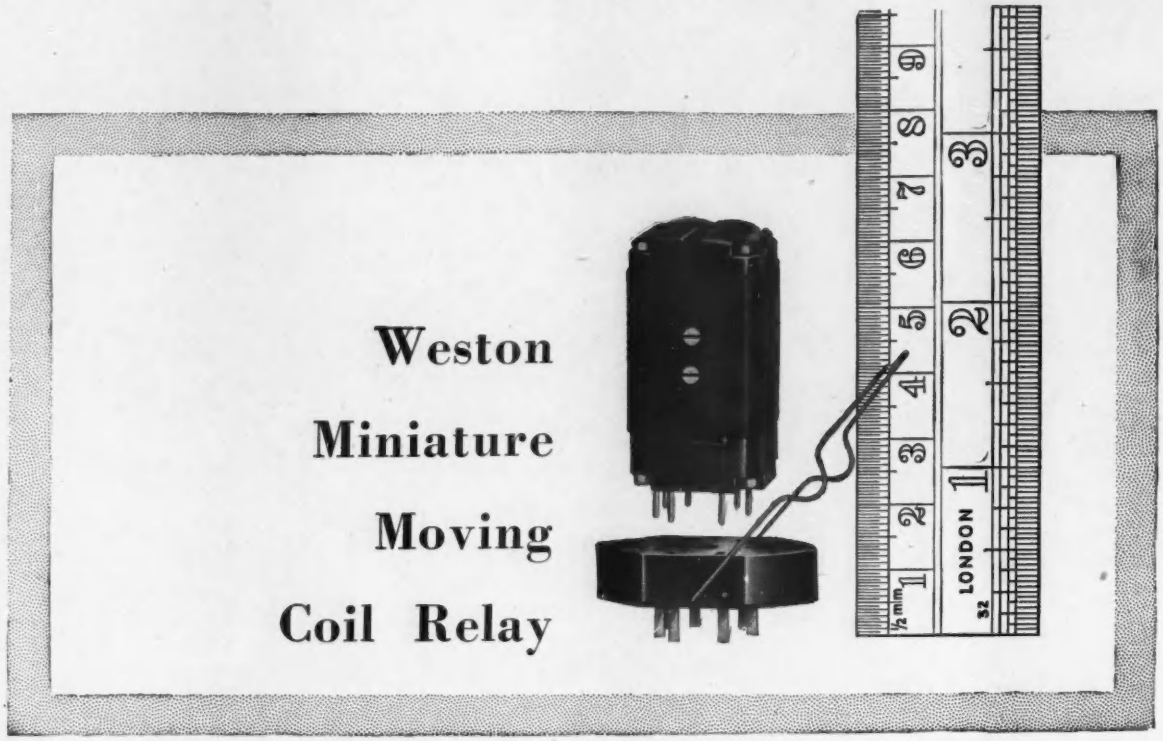
HACKBRIDGE pole mounting transformers are used extensively in many of the world's largest distribution systems and the outstanding performance of the many thousands of these units installed during a period of over 25 years emphasises the supreme reliability of Hackbridge Transformers for this type of service.

Send for publication D.B.2.



RIGHT: A 50 kVA 33/11 kV. three phase Hackbridge transformer for pole platform mounting.

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric, Walton-on-Thames"



The "Weston" Model S.115 Miniature Moving Coil Relay functions as a sensitive "on-off" current switch, and will operate on a power input of only 5 microwatts. Generally the relay is supplied with a centre stable moving contact, but a biased version which affords a single break, or a break followed by a make, is also available. The moving coil can be provided with two windings which offer considerable scope in circuitry. The relay has a seven pin base and is supplied with a separate chassis or panel mounting socket with retaining clip: mounting position is unimportant. Size $1\frac{1}{2}''$ x $\frac{3}{4}''$ x $2\frac{1}{4}''$, weight $1\frac{3}{4}$ oz. only. List No. W.46 gives further particulars and is available on request, but these relays give best service when they are specially designed to suit the circuit in which they are to be used, and we shall be delighted to co-operate on receipt of the pertinent information.

Other WESTON relays

MODEL S54. A relay of extreme sensitivity (size 4-1/5" x 3-1/5"). The high torque developed by the moving system ensures positive contact pressure. Leaflet — List No. W.45 gives details.

MODEL S124. A sensitive relay (size 2-3/16" x 2-3/16") with magnetic hold-on contacts having a higher rating than the other models. Leaflet — List No. W.43 gives details.

SANGAMO WESTON LIMITED

ENFIELD, MIDDLESEX · TEL: ENField 3434 (6 lines) & 1242 (6 lines) GRAMS: SANWEST, ENFIELD

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151

Branches: London, CHAncery 4971 · Glasgow, Central 6208 · Manchester, Central 7904 · Newcastle-on-Tyne, Newcastle 26867 · Leeds, Leeds 30867 · Liverpool, Central 0230 · Wolverhampton, Wolverhampton 21912 · Nottingham, Nottingham 42403 · Bristol, Bristol 21781 · Southampton, Soton 3328 · Brighton, Brighton 28497

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

BOROUGH OF SCUNTHORPE

LIGHTING IMPROVEMENTS

TENDERS are invited for the supply of reinforced concrete columns, mercury discharge lanterns and ancillary gear, and the erection and wiring of 52 No. 25 ft columns and 14 No. 15 ft columns.

Contract documents may be obtained from, and drawings inspected at, the office of the Borough Surveyor, Mr Cyril Cooper, M.I.C.E., Comforts Ave, Scunthorpe, Lincs, on payment of a returnable deposit of £2. 2s.

Tenders in the envelopes provided must be received by the undersigned by 12 noon on Wednesday, 12 Jan., 1955.

W. P. ERRINGTON,
Town Clerk.

Municipal Offices,
34 High St, Scunthorpe.
13 Dec., 1954. (P 243)

BOROUGH OF NEWBURY

OXFORD ROAD (A.34)—LIGHTING SCHEME

TENDERS are invited for the supply and erection of 24 lanterns and steel columns in connection with the above scheme as follows:

1. The supply of electrical equipment.
2. The supply and erection of steel columns together with fitting and wiring of electrical equipment offered in their own tender.
3. The supply and erection of steel columns together with fitting and wiring of electrical equipment provided by another firm.

Form of Tender, Specification and Bill of Quantities may be obtained from the Borough Surveyor and Water Engineer, Municipal Buildings, Newbury, at whose office plans and general conditions may be inspected.

Sealed Tenders endorsed "Tender Lighting" must be delivered to the undersigned not later than 9 a.m. Monday, 17 Jan., 1955. The Corporation does not bind itself to accept the lowest or any tender.

LESLIE SOUTHERN,
Town Clerk.

Municipal Buildings,
Newbury, Berks. (P 265)

FLINT BOROUGH COUNCIL

ELECTRICAL INSTALLATION—15 HOUSES AND 2 FLATS, CASTLE WARD HOUSING SITE, FLINT

TENDERS are invited for the Electrical Installation at the above. Documents may be obtained from the Borough Engineer and Surveyor, Municipal Offices, Earl St, Flint, on payment of a deposit of £1 refundable on receipt of a bona fide tender.

Tenders to reach the undersigned not later than 10 a.m. Tuesday, 25 Jan., 1955.

The Council do not bind themselves to accept the lowest or any tender.

D. H. DAVIES,
Town Clerk.

Town Hall,
Flint.
Dec. 1954. (P 264)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF THIRD ASSISTANT ENGINEER (MAINS) CONSTRUCTION SECTION, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER, 8

APPLICANTS should have had experience in the design, erection and installation of overhead and underground mains up to and including 33 kV.

Experience in estimating will be considered an advantage.

Applicants should have obtained the H.N.C. in Electrical Engineering or hold an equivalent qualification.

Commencing salary, according to qualifications and experience within range £750/£875 p.a. rising subsequently to £975 p.a. Class AX/EX, Grade 4, N.J.B. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 8 Jan., 1955.

APPOINTMENT OF (*a*) GENERAL ASSISTANT ENGINEER (WORKSHOP SUPERVISOR) (*b*) GENERAL ASSISTANT ENGINEER (APPLIANCE TESTING), DOMESTIC APPLIANCE WORKSHOP, WALKDEN

Applicants for post (*a*) should have experience of supervising the mechanical and electrical repair and overhaul of all types of electrical appliances, and experience of machine tools and general workshop equipment.

Applicants for post (*b*) should have experience of routine and type testing and be capable of preparing reports dealing with the construction and performance of all types of electrical appliances.

Salary Scale (both posts): £715 x £15—£760 p.a. Grade L.13, N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 5 Jan., 1955.

Note.—Persons who applied in response to the previous advertisements of the above posts need not re-apply.

APPOINTMENT OF SENIOR SERVICE CENTRE ASSISTANT (MALE), CARLISLE DISTRICT

Applicants should be of good educational standard and should preferably have obtained the E.D.A. Salesmanship Diploma. Experience in the supervision of Service Centre Staff, publicity, window dressing and Service Centre stock control is essential. Experience in exhibition work would be an added advantage.

Salary Scale: £545/£605 p.a. Grade 3, N.J.C. Conditions.

Applications to Sub-Area Manager, The North Western Electricity Board, No. 6 Sub-Area, Castle Green, Kendal, by 5 Jan., 1955. (P 247)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (INSTRUMENTS)
(*a*) BANKSIDE GENERATING STATION
Vacancy No. 54/1065
(*b*) BRUNSWICK WHARF GENERATING STATION
Vacancy No. 54/1066

Experience of all types of instruments necessary with experience of Automatic Boiler Control Equipment an advantage.

(*a*) Salary—Class H, Grade 12=£666. 15s per annum.
(*b*) Salary—Class K, Grade 14=£666. 15s. per annum.

(Previous applications for these posts will be considered.)

ASSISTANT ENGINEER (ELECTRICAL TESTING) FULHAM GENERATING STATION
Vacancy No. 54/1067

Practical experience in the testing and routine maintenance of Generating Station electrical equipment including Generators, Switchgear, Transformers. Motors and associated protective equipment is essential. Salary—Class K, Grade 12=£750. 15s. per annum.

ASSISTANT ENGINEER (EFFICIENCY AND TEST) FULHAM GENERATING STATION
Vacancy No. 54/1068

Candidates should have received a sound technical education and possess knowledge of technical records in a modern Power Station, also experience with Testing of Power Station Plant. Salary—Class K, Grade 14=£666. 15s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (P 245)

MANCHESTER CORPORATION
Transport Department

TECHNICAL ASSISTANT (Electrical), required in the Chief Engineer's Section at a salary of £560/£640 per annum. Candidates should possess technical qualifications not less than the Higher National Certificate, and preferably Graduate Membership of the Institute of Electrical Engineers. Forms of application together with full details of the duties attached to the post can be obtained from the General Manager, Manchester Corporation Transport Department, 55 Piccadilly, Manchester 1, and should be submitted to him with copies of not more than two recent testimonials not later than Friday, 7 Jan., 1955. Canvassing is prohibited. (P 249)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Ayrshire Sub-Area

THIRD ASSISTANT ENGINEER—PLANNING AND DEVELOPMENT

APPLICATIONS are invited for the position of Third Assistant Engineer (Planning and Development) at Sub-Area Headquarters, Kilmarnock.

Applicants should be experienced in the design of modern H.V. and L.V. distribution systems and of protective equipment. They should be Graduate Members of the I.E.E. or possess equivalent qualifications.

Salary and conditions will be in accordance with the National Joint Board Agreement, Class "G," Grade 10, £675/£720 per annum subject to statutory deductions including income tax and superannuation.

Forms of Application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me duly completed with any additional information not later than 28 Dec., 1954.

A. E. ROOTS,
Manager.

Greenholm St,
Kilmarnock.
13 Dec., 1954. (P 248)

ELECTRICAL ENGINEERS
(Distribution)

required by the CENTRAL ELECTRICITY BOARD, MALAYA. Salary scale (including expatriation pay and present temporary allowance at rate for single men) equivalent to £1,197 rising to £2,100 a year. Commencing salary according to qualifications and experience. Additional temporary allowances totalling £210/£399 a year (married men), and £301/£630 (family men). Option of appointment either (*a*) on agreement for three years with prospect of permanency or (*b*) on contract for three years with gratuity of £200/£280 a year. Opportunity of terminating appointment after one year's service. Free passages. Liberal leave on full salary. Candidates must have had sound training in both electrical and mechanical engineering with experience in the operation of medium Electricity Supply Undertakings and possess a competent knowledge of the maintenance of high and low tension overhead and underground A.C. distribution systems and substation plant. They should preferably be Corporate Members or Graduates of the Institute of Electrical Engineers or possess degrees or other qualifications carrying exemption from the Institute's Graduate examination. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40440/EE. (P 246)

BRITISH ELECTRICITY AUTHORITY
South East Scotland Division

GENERAL ASSISTANT ENGINEER (TRANSMISSION) required for the southern transmission section at Melrose Rd, Galashiels.

Applicants should possess H.N.C. in Electrical Engineering or equivalent qualification and preferably have had some works training or experience in construction of H.V. substations.

Salary scale £600/£745 (N.J.B. Class AB/BX/6).

Placing according to experience. Pension Scheme.

Apply in writing by 4 Jan., 1955, to Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, High St, Portobello, Midlothian. (P 257)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
(North Caledonia)

APPLICATIONS are invited for the post of DEMONSTRATOR/SALESWOMAN in the Buchan Banffshire territory of the Board.

Applicants should have at least two years' training in domestic science and be experienced in demonstrating and selling electrical appliances.

Salary in accordance with N.J.C. Grade 1 £400/£490 per annum. Superannuation scheme applicable.

Applications, in confidence, stating age, qualifications and experience to be addressed to the Area Manager, West Villa, South St, Elgin, not later than Saturday, 8 Jan., 1955. (P 266)

SOUTHERN ELECTRICITY BOARD
JUNIOR ENGINEER

SWINDON DISTRICT of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 14 (£475/£520 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with distribution including minor construction work and general maintenance. Applicants should have received technical training to O.N.C. standard and have experience of similar work.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, and returned to him in envelopes suitably endorsed not later than 8 Jan., 1955. (P 260)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following position within the Division:
SHIFT CHARGE ENGINEER,
AVON POWER STATION, WARWICK
Vacancy No. 186/54/ET

Applicants should be suitably qualified and have had experience in the operation of modern boiler and turbine plant.

Salary in accordance with Class E, Grade 7 (£715 x £15—£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 30 Dec., 1954.

This appointment will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy No.

L. F. JEFFREY,
Divisional Controller.
10 Dec., 1954. (P 259)

SOUTH EASTERN ELECTRICITY BOARD
DISTRICT COMMERCIAL ASSISTANT (N.J.C.)
Eastbourne District

SALARY £485 x £20—£545 p.a. under N.J.C. Grade 2. Superannuable. Applicants should have experience in negotiating supplies, load development, consumers services, tariffs, sales of electrical appliances and organisation of exhibitions.

Applications, naming two referees, on forms from J. E. Winborne, District Manager, SEEBoard, Electric House, Grove Rd, Eastbourne, by 5 Jan., 1955.

A. L. BURNELL,
Secretary.
(P 244)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for the following positions in the Generation (Operation) Department. N.J.B. service conditions, superannuable appointments, salaries within Schedule "A" of the Agreement:

(*a*) SHIFT CHARGE ENGINEER at Nechells "A" Power Station, Grade F7, commencing salary £755 per annum (Vacancy No. 844MD).

(*b*) MAINTENANCE ENGINEER (Mechanical) at Stoke Power Station, Grade E6, commencing salary £755 per annum (Vacancy No. 845MD).

(*c*) JUNIOR ENGINEER at Hams Hall "B" Power Station, Grade K18, commencing salary £475 per annum (Vacancy No. 846MD).

Applicants for these positions should have received sound technical training and practical experience, in particular for (*a*) in the operation and maintenance of steam generating plant, including pulverised fuel fired boilers, and main switchgear, and for (*b*) in the maintenance of power station mechanical plant. Appropriate technical qualifications an advantage.

Apply, quoting the vacancy number, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 10 Jan., 1954. (P 268)

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ASSISTANT ELECTRICAL ENGINEER, Grade IV, £675 x £30 to £825 p.a. plus London weighting. Should be Corp. Members I.E.E. and experienced in preparation of schemes, specifications, drawings and estimates for, and supervision of, installations of electrical services in large buildings.

Full details of present and previous appointments and salary attaching thereto, accompanied by copies of 3 recent testimonials, to County Architect, County Hall, Kingston, by 31 Dec., 1954. (P 258)

NORTH WESTERN GAS BOARD
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ELECTRICAL SUPERVISORS

APPLICATIONS are invited for the above pensionable appointment at a salary within Grades A.P.T. 5/7 (£500/£665 per annum).

Applicants should have experience in the operation, repair, maintenance and installation of A.C. and D.C. motors and starters up to 500 h.p., H.V. and M.V. switchgear and fusegear, rectifiers, p.l.l.c.s.w.a. and s. cables and conduits.

Previous experience in the control of electrical personnel and technical qualifications would be an advantage.

Applications should be made on the official form obtainable by writing to the Chief Personnel Officer, N.W.G.B. (Liverpool Group), Radiant House, Bold St, Liverpool 1, and returned to him within 14 days. (P 267)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for superannuable N.J.B. appointment of SHIFT CHARGE ENGINEER at Llanelly Power Station. Salary E.7, £715 x £15—£760 per annum.

Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Operating experience in a Power Station essential.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 7 Jan., 1955. (P 269)

ASSISTANT ELECTRICAL ENGINEER for Power Station construction in South Wales. Must be familiar with electrical testing and commissioning procedure. Salary according to experience. Write Box E.T.660, c/o 191 Gresham House, E.C.2. (P 252)

CABLE ESTIMATOR required. Age about 25 years, with experience in cable design and works estimates. Central London Area. Please send full details to—Box No. 4109, Electrical Times. (P 256)

DESIGN ENGINEER required for the development of outdoor type high voltage isolating switches and fuse gear for 11 kV and above. Applicants must have had good Drawing Office training and experience in the design of similar equipment. Write, giving full particulars of experience, age and salary required to—Box No. 4101, Electrical Times. (P 210)

ELECTRICAL DESIGNER required. Must have practical experience in the design of A.C. and D.C. motors, 1-200 B.H.P. Reply in confidence, stating age, experience, and salary expected. Hugh J. Scott and Co. (Belfast) Ltd., Volt Works, Ravenhill Rd, Belfast. (P 229)

ELECTRICAL WHOLESALER, experienced COUNTER HAND required, also ASSISTANT. Apply Newey and Eyre Ltd., 243 Horn Lane, Acton, W.3. (P 107)

ELECTRICIAN required by London Electricity Board in Islington District of Northern Sub-Area. N.J.I.C. rates and conditions. 4s. 1d. p.h. Application forms from Personnel Officer, 46 New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: M/3576/T. (P 251)

FULL-TIME REPRESENTATIVE required by well-established manufacturers of high grade switches to cover the Northern Counties of England. Pleasant personality and contacts with leading electrical manufacturers and Area Boards. Knowledge of switching applications particularly packet, rotary and toggle switches an advantage. Reply giving full details including experience, remuneration expected and whether a car owner to—Box No. 4093, Electrical Times. (P 191)

AIRCRAFT ELECTRICAL INSTALLATIONS

The Bristol Aeroplane Co., Ltd., at Filton requires to recruit the following staff into the Electrical Section of their Aircraft Design Office.

(*a*) AIRCRAFT ELECTRICAL DESIGN ENGINEERS, who have a degree in Electrical Engineering or equivalent qualifications, and experience in the design of aircraft electrical components and installations.

(*b*) ELECTRICAL LAYOUT AND CIRCUIT DRAUGHTSMEN, who have the H.N.C. or O.N.C. in Electrical Engineering, or the equivalent City and Guild's qualifications, or who have served an apprenticeship in electrical engineering.

Selected draughtsmen without experience of aircraft electrical design work will be considered for training.

Applications giving details of experience, qualifications and salary required, quoting D.O.29, should be addressed to the Personnel Manager, The Bristol Aeroplane Co., Ltd., Aircraft Division, Filton Hse, Bristol. (P 182p)

GENERAL REPRESENTATIVE with ability required by a leading electrical engineering company for the County of Hertfordshire.

Write with full details of age, experience, qualifications and salary required, to Box No. 8225, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (P 263)

JUNIOR TECHNICAL ASSISTANT required for illuminating engineering department of old-established manufacturers of lighting equipment for the preparation of Lighting Schemes, etc. Apply in writing stating age, experience and salary required, to Chief Engineer, Technical Service Dept., Holophane Ltd., Elverton St, Westminster, S.W.1. (P 250)

LEADING OIL COMPANY requires one ELECTRICAL ENGINEERING DRAUGHTSMAN for work in London. Age 25 to 30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualification. Good practical experience required followed by 3 to 5 years in the drawing office on electrical installations for Process Plants, Workshops and Factories. He will have opportunities of visiting refineries for periods of temporary duty. Opportunities for promotion to engineering appointments occur within the Company and with its Associates both in the U.K. and overseas. Write giving full details and quoting H.3261 to Box 7141, c/o 191 Gresham House, E.C.2. (P 253)

LABORATORY MECHANIC required by The Research Laboratories of British Insulated Callender's Cables Limited at Shepherds Bush for the construction of experimental apparatus. Applicants should be versatile and used to working with machine tools to fine limits. 5 day week. Pension Fund. Apply in writing, stating age, qualifications, experience, salary required and quoting reference L/66/54 to Staff Officer, British Insulated Callender's Cables Limited, 21 Bloomsbury St, London, W.C.1. (P 238)

LAYOUT DRAUGHTSMAN required by Consulting Engineers for electrical layout work including EHV and LV outdoor substations, indoor switchgear and cable diagrams. Salary in accordance with qualifications. Apply in writing reference KJB/RFS to Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1. (P 254)

MERZ AND McLELLAN require ELECTRICAL ENGINEERING DRAUGHTSMEN for their Esher Office. Applicants should be fully experienced in layout work, cabling, etc., preferably in connection with steam power station design. The salaries offered will be fully appropriate to the applicants' experience. Pension Scheme. Five-day week. Apply in writing to Merz and McLellan, "Milburn," Esher, Surrey. (P 241)

PAKISTAN — ELECTRICAL ENGINEER—The General Electric Co., Ltd., has an opening in the Contracts and Installation Department in Pakistan for an electrical engineer, preferably aged between 25 and 30. This vacancy requires an engineer who has served an apprenticeship with an electrical contracting firm and who has had practical experience in installation work in factories and commercial buildings. The work will consist of designing, estimating and executing installation work of all types. Appointment is on a contract for four years in the first instance with six months' furlough at the end of that period. Apply in writing to the Staff Manager (Ref. P.E.) The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, stating age, qualifications and experience. (P 239)

RESEARCH LABORATORIES, British Electricity Authority, Leatherhead, require TWO GENERAL ASSISTANT ENGINEERS. Candidates should have a University degree or equivalent qualifications in Electrical Engineering or in Physics. Duties include research on electrostatic precipitation and allied problems at Leatherhead and Croydon Laboratories. Salary N.J.B. Grade 4, £675/£850 p.a.

Applications stating age, qualifications, experience and present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 17 Jan., 1955. Quote reference ET/541. (P 255)

SALES ENGINEER required for London and Southern Counties by progressive company manufacturing Switchgear and Distribution equipment. Applicants should preferably have had experience in the manufacture, installation and operation of distribution equipment for MV and HV systems. Write, giving full particulars of experience, age and salary required to—Box No. 4099, Electrical Times. (P 209)

SENIOR or JUNIOR DRAUGHTSMAN required for work on electrical power resistors and large electrical heaters for industrial applications. Previous experience on this class of work is desirable but not essential.

Apply giving full details including age, technical qualifications, whether married or single, and salary required to the Expanded Metal Co., Ltd., Electrical Department, Stranton Works, West Hartlepool. (P 181)

THE ENGLISH ELECTRIC CO., LTD., Stafford, has interesting vacancies for ENGINEERS to assist with contracts for comprehensive hydro - electric schemes. Applications are invited from those having experience of this type of work and also from young engineering graduates or H.N.C. holders who have a background of practical engineering experience, preferably with a commercial bias. Please apply to Dept. C.P.S., 336/7 Strand, W.C.2, quoting ref. 756D. (P 108)

WELL-KNOWN Electrical Manufacturing Company has a vacancy for a SALES ENGINEER for electrical rotating machinery in Sheffield. Successful applicant must be a trained Electrical Engineer with O.N.C. as a minimum qualification and with previous sales experience in the area covered. He will work from the Company's existing Branch Office. Remuneration by salary and expenses. Non-contributory pension scheme. Apply—Box No. 4065, Electrical Times. (P 111)

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(P 212p)

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ELECTRICAL ENGINEER with Consulting Engineering experience seeks appointments, inspections, reports and recommendations, site supervision, etc. Fees reasonable. Telephone REL 2739 or—Box No. 4805, Electrical Times. (P 171)

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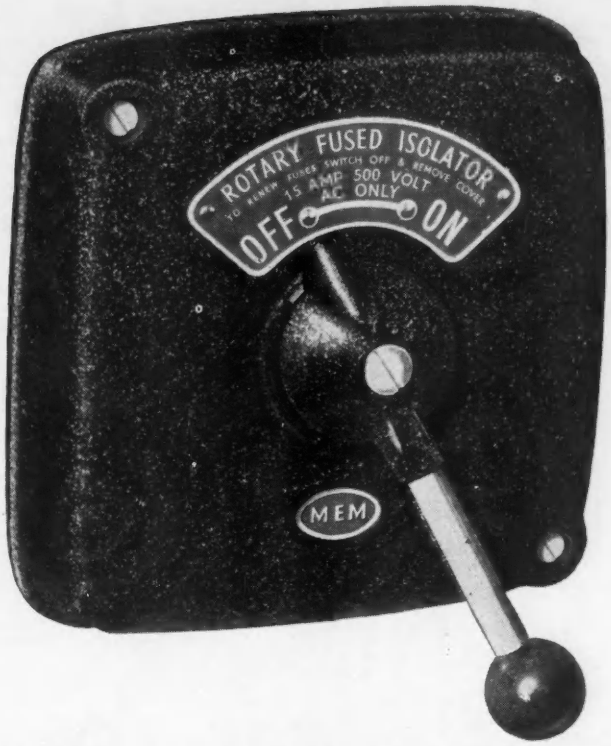

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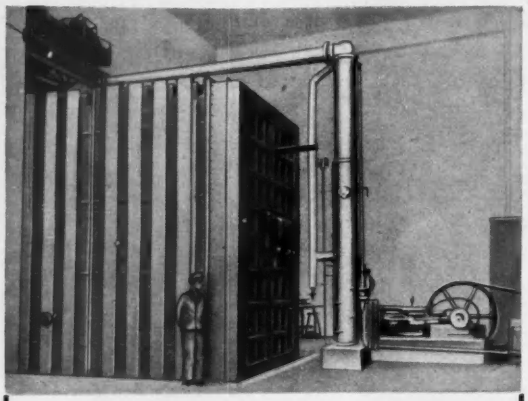

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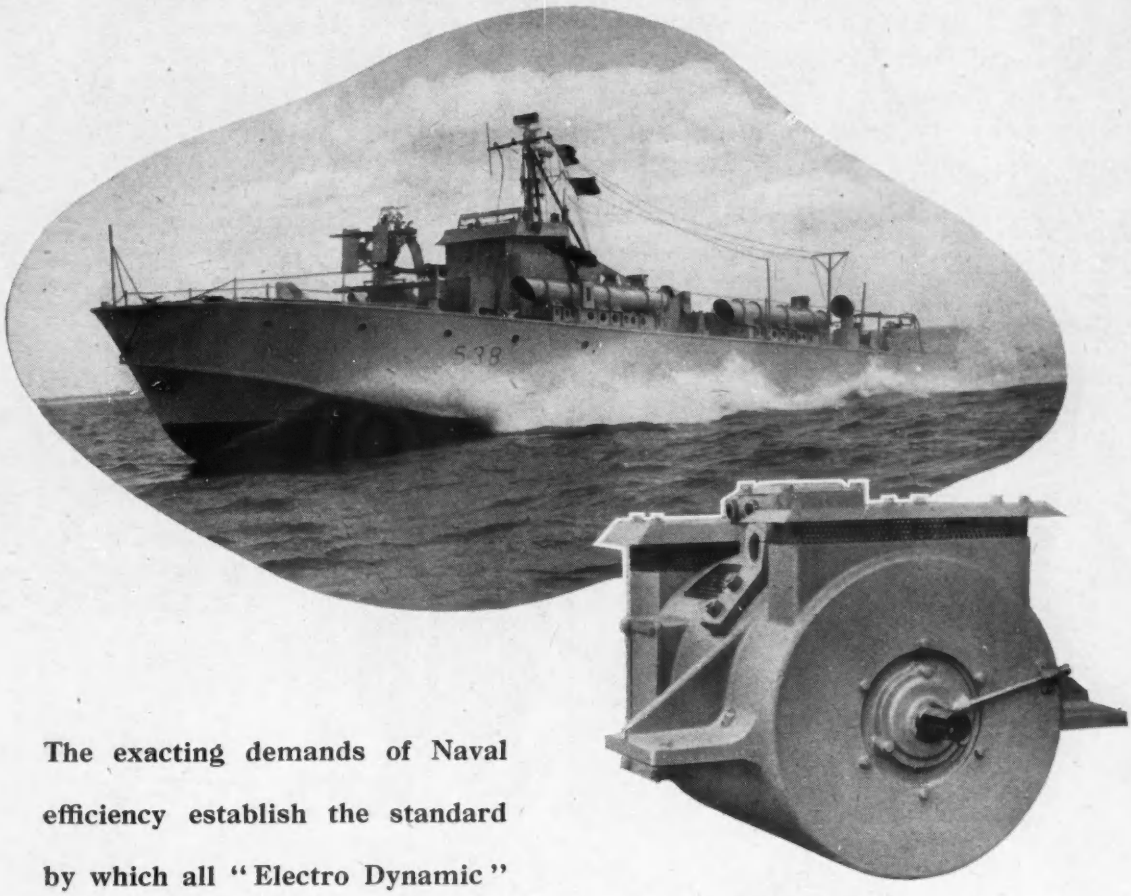

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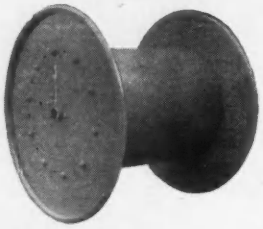
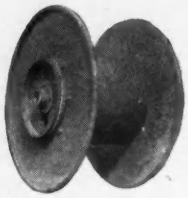
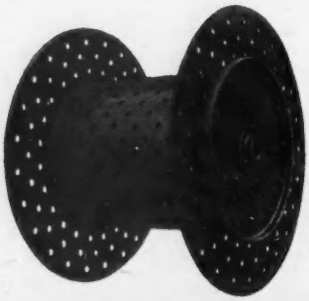




FOR THE ELECTRIC WIRE AND CABLE TRADE



Makers of all kinds of wood and steel reels for the electric wire and cable trades.

Our speciality :- Steel flanges with very strongly beaded edges in a wide range of diameters, and friction rings made wholly from mild steel.

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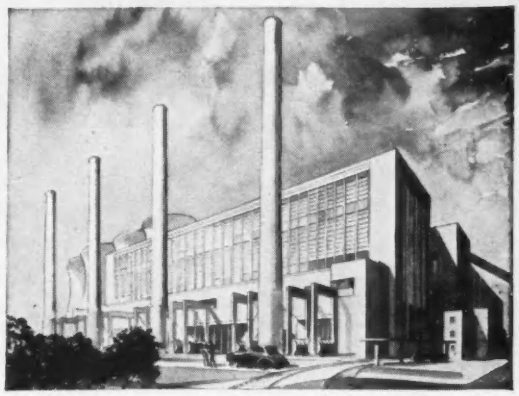
Taaibos POWER STATION

LARGEST BOILERS IN SOUTH AFRICA



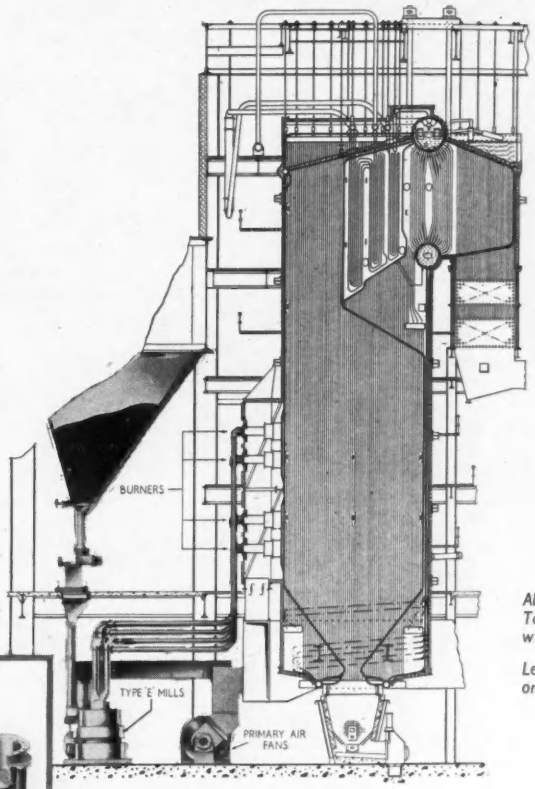
THE eight 580,000 lb./hr. Babcock boilers for the new Taaibos power station of the Rand Undertaking*, of which the first units will soon be in commission, will be the largest boilers in South Africa.

Of modern, Bi-drum design, over 130 feet in height they are pulverized-fuel-fired, using low-grade coal from the coal field on which the station is being built; each boiler being served by four Babcock type E pulverizing mills, so connected to the sixteen horizontal intertube circular p.f. burners as to ensure even flame distribution at reduced loads, with one or more mills shut down.

Ash and dust handling are by the Babcock *Hydrojet* and *Hydrovac* systems.

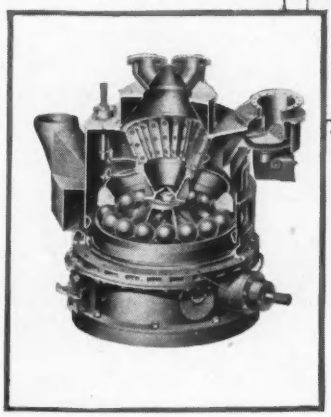
Taaibos is a major undertaking in an impressive programme of South African electrical development, for which over 60 per cent of the steam-raising plant is being supplied by Babcock & Wilcox.

* *Electricity Supply Commission of the Union of South Africa.*



Above: Impression of Taaibos power station when completed.

Left: Arrangement of one of the boilers.



Sectional view of the Babcock type E pulverizing mill, with integral classifier, of which 32 are being supplied for Taaibos power station.

BABCOCK BOILERS

BABCOCK & WILCOX LTD. BABCOCK HOUSE, FARRINGDON ST., LONDON, E.C.4

UNION OF SOUTH AFRICA: BABCOCK & WILCOX OF AFRICA (PTY.) LTD. JOHANNESBURG

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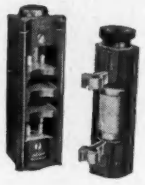
"G" TYPE FUSES

Vibration proof, sizes 15, 30, 60 and 100 amp. Ratings for 250/500 volts with rewireable fuse-links, or H.R.C. cartridges. Leaflet EW40, sent on request, gives full details.



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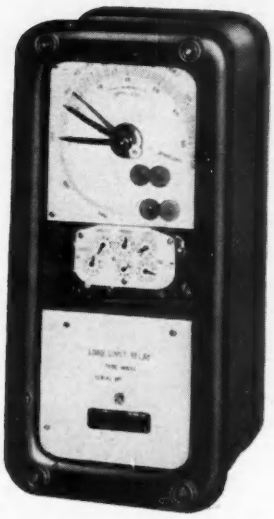

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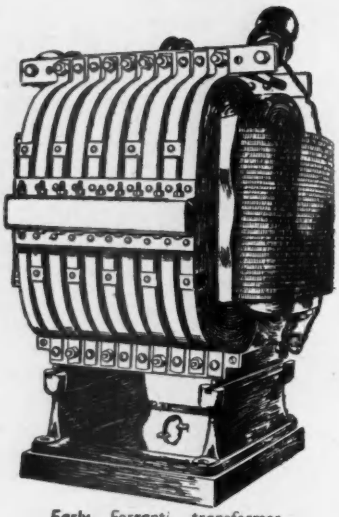

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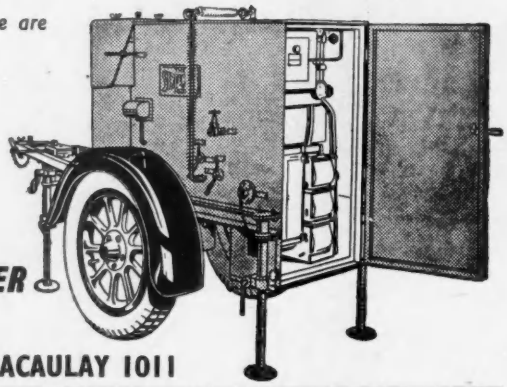

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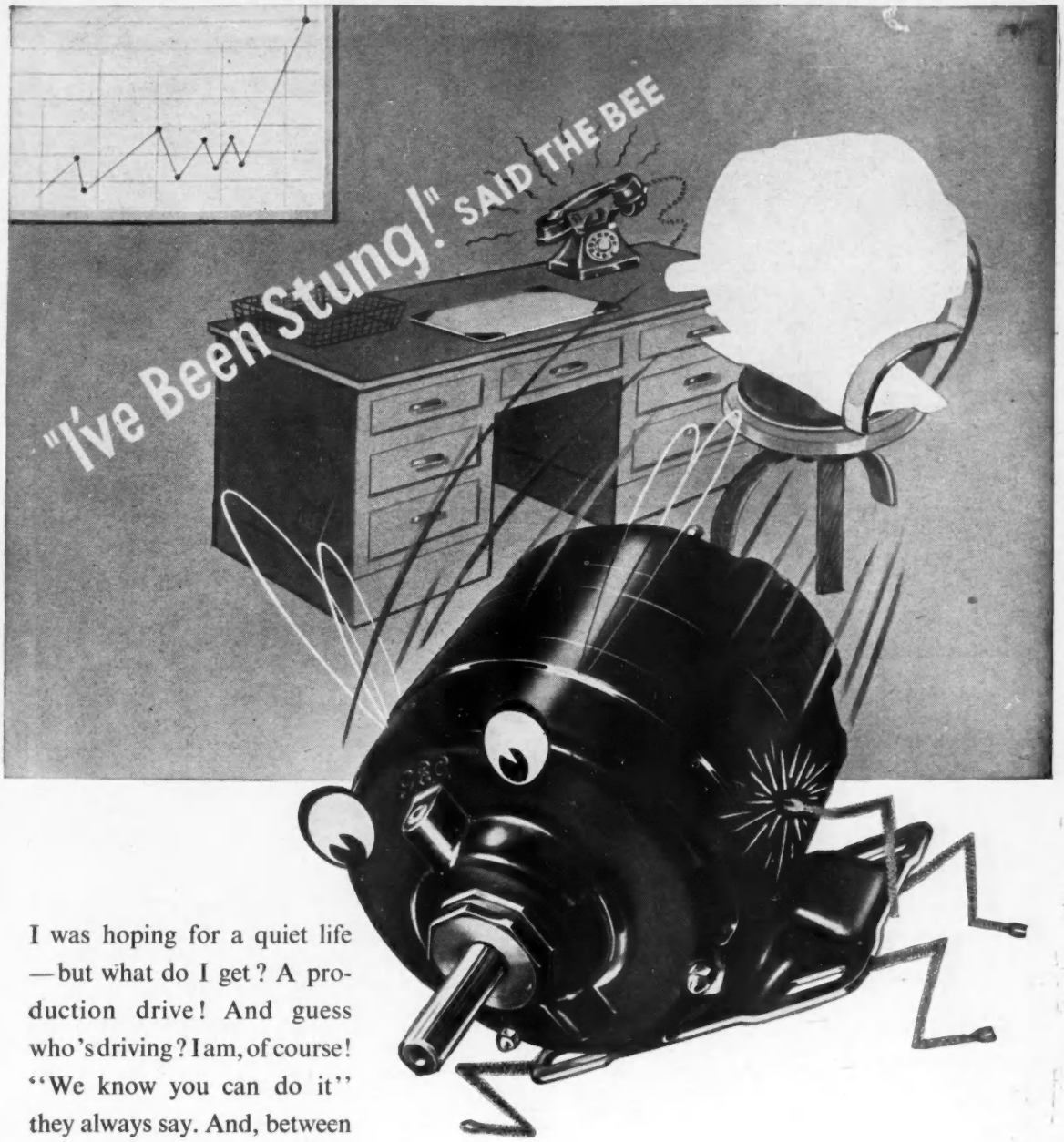
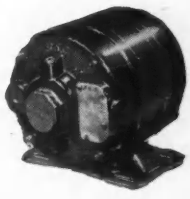


I was hoping for a quiet life —but what do I get? A production drive! And guess who's driving? I am, of course! "We know you can do it" they always say. And, between you and me, I *can*. Oh well, I suppose it's just the way I'm made!

I'm a Busy Little Bee from G.E.C.

G.E.C. Fractionals



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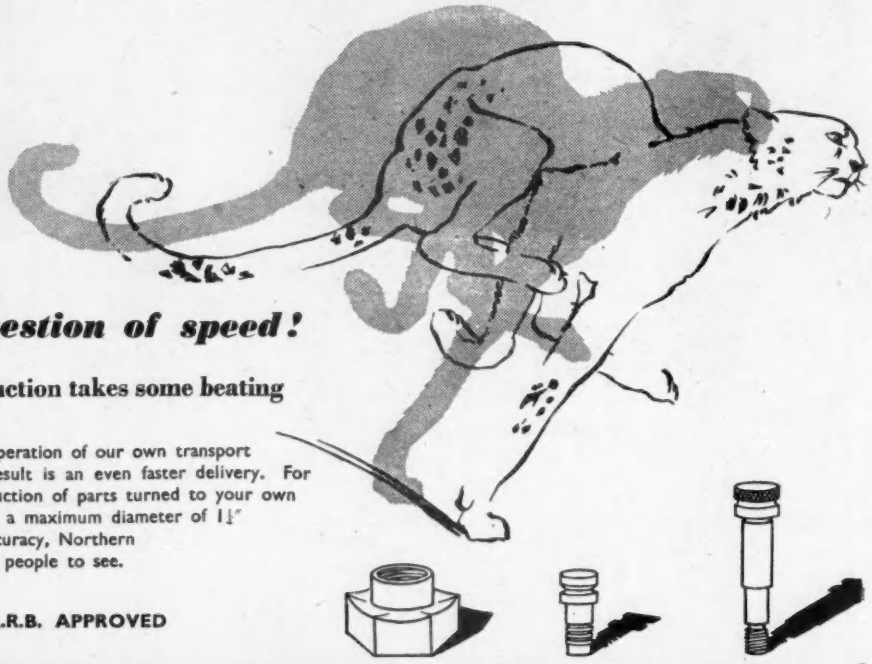

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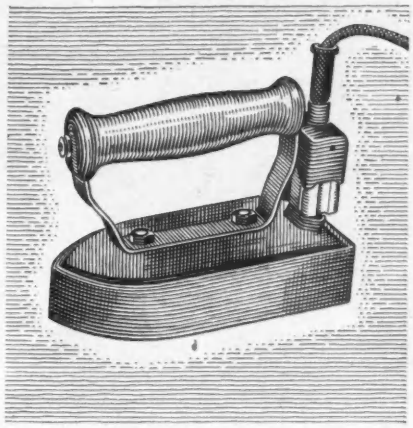

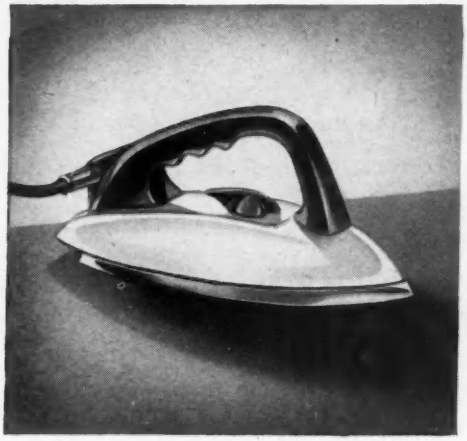

Since the early days of domestic electrical heating a great deal of research has been done. The result : the Brightray series of nickel-chromium resistance materials — outstandingly reliable, and with special grades to suit all domestic and industrial applications. Let us help you select the one most suitable for *your* requirements.

BRIGHTRAY C for intermittent heating and cooling cycles up to 1150°C: particularly suitable for fires, irons, cookers, heating plates, etc.

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The Mardrive clutch worm reduction unit is invaluable for low speed drives where it is necessary to start and stop instantly and at more frequent intervals than is possible by direct switching of the motor.

The unit has simple, adjustable, belt tension between the unit and the driven member.

By the use of varying ratios of worm reducers a speed range of from 10 r.p.m. to 115 r.p.m. is readily attainable and with variations of the pulley sizes, this range can be further increased.

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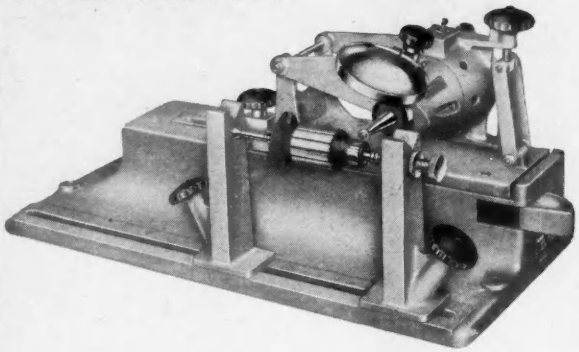

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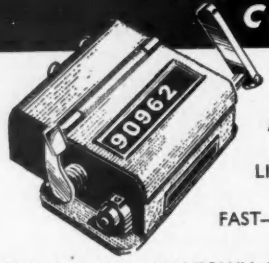

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It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Size 8¼" x 7½" x 4½"
Weight 6¼lbs. (including leads)

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10V.	250μA.	10V.	1A.	*Maximum indication* 20MΩ.
25V.	1mA.	25V.	2·5A.	0—2,000Ω { using internal batteries.
100V.	10mA.	100V.	10A.	0—200,000Ω { using internal batteries.
250V.	100mA.	250V.	—	0—20MΩ { using internal batteries.
1,000V.	1A.	1,000V.	—	0—200MΩ { using external batteries.
2,500V.	10A.	2,500V.	—	

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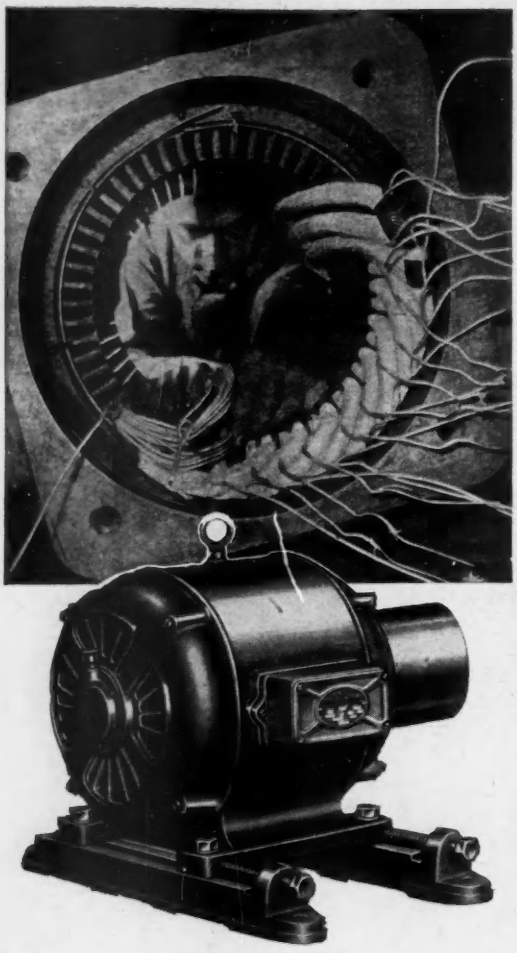

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also
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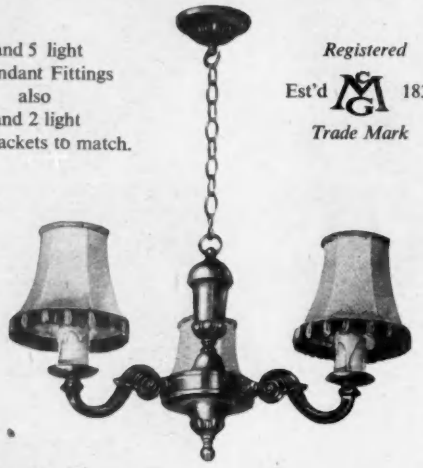

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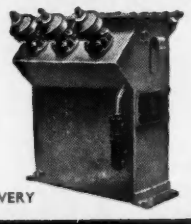

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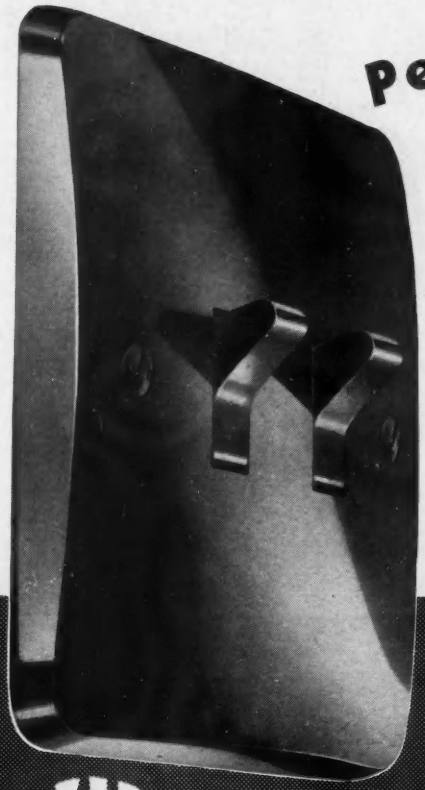

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Price★

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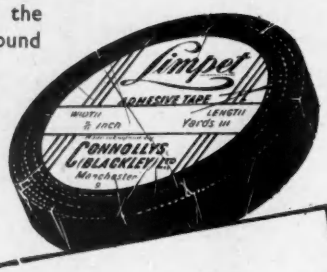

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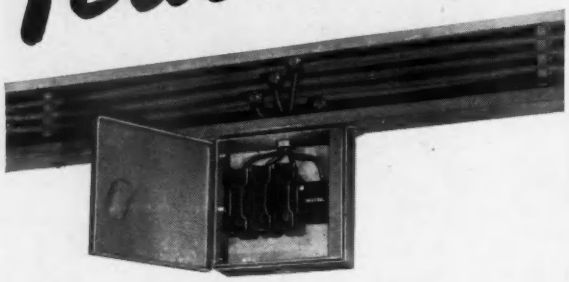

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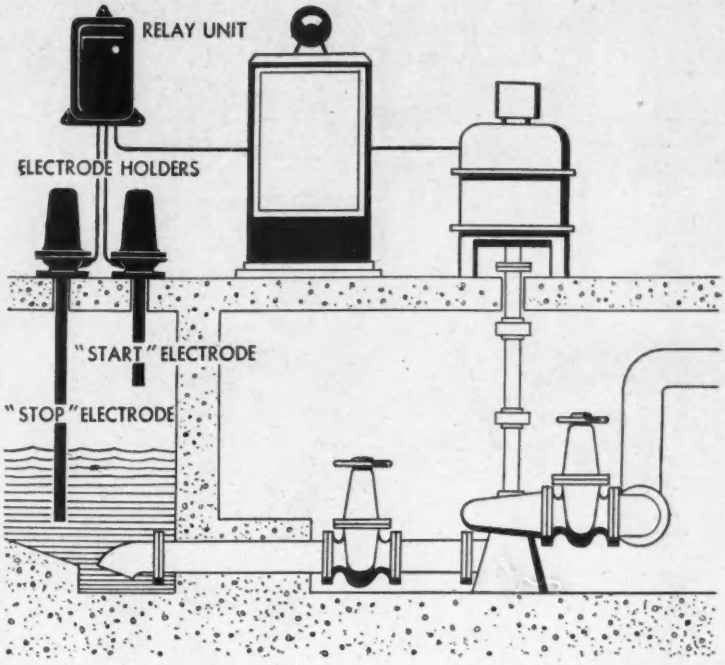
"NOFLOTE" CONTROL MEANS TROUBLE-FREE PUMPING



How the "Noflote" system works. A special relay is connected by two wires to two electrodes projecting into the liquid. The electrodes are different lengths, adjusted to correspond with the two levels between which the pump is required to operate. The liquid completes an electrical circuit through the electrodes, which actuates the relay and in turn operates the pump motor. The relay can be mounted in any accessible position often some distance away from the sump.

CHECK HERE WHY "NOFLOTE" CONTROL IS BETTER

1. No floats or moving parts.
2. Electrodes take up very little space.
3. No stilling pipes or guide tubes are required.
4. No submergence error—liquid controlled within fine limits.
5. Easy to install.
6. Adjustments in operating level made above the sump.
7. Negligible maintenance costs.
8. Reliable in service.

Please write for Publication No. J234

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6/140

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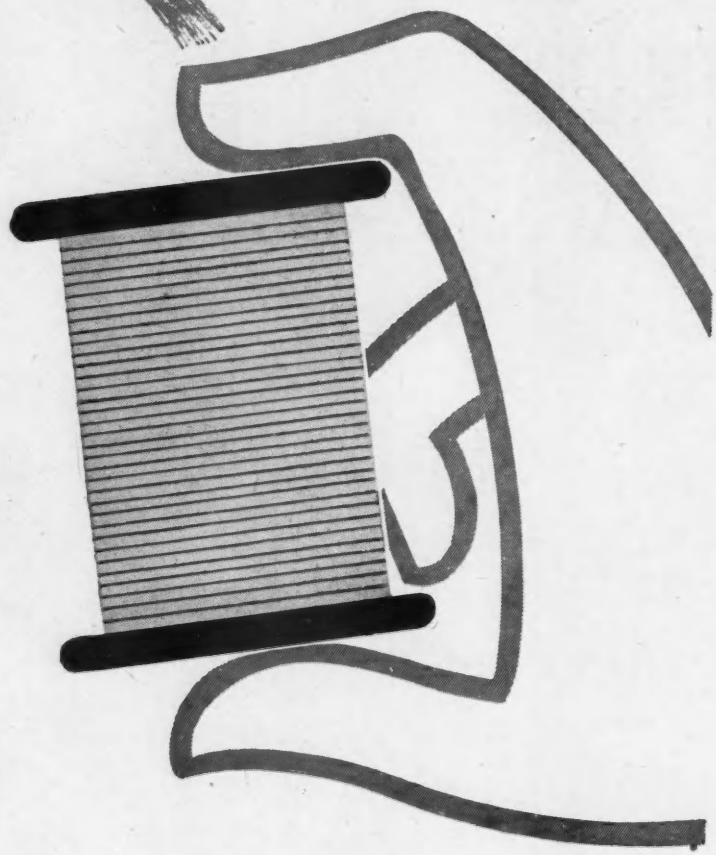

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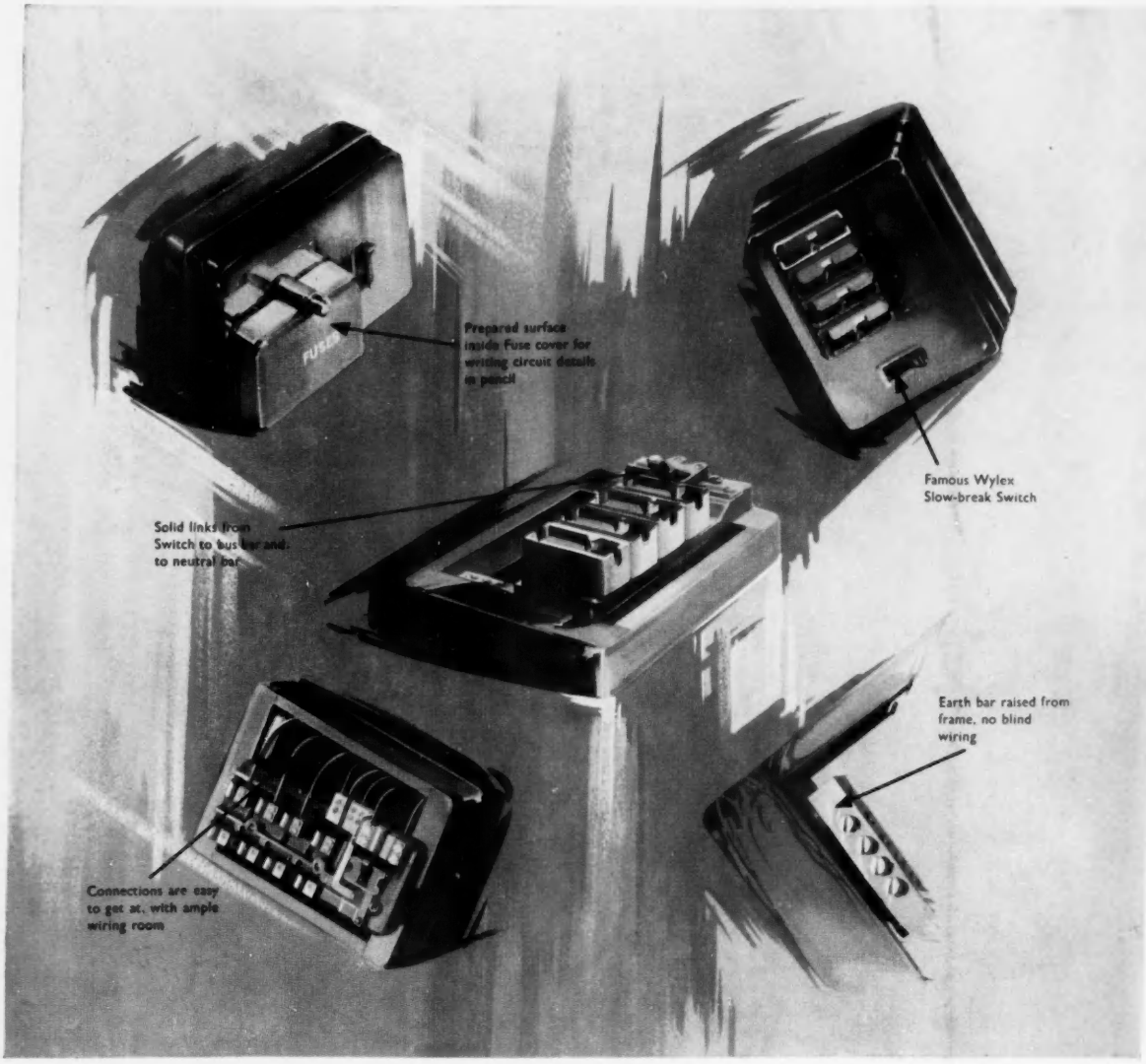
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